Chapter : 3. LINEAR EQUATIONS IN TWO VARIABLES

Exercise : 3A

Question: 1

Solve each of the

Solution:

For equation, $2x + 3y = 2$

First, take $x = 0$ and find the value of y.

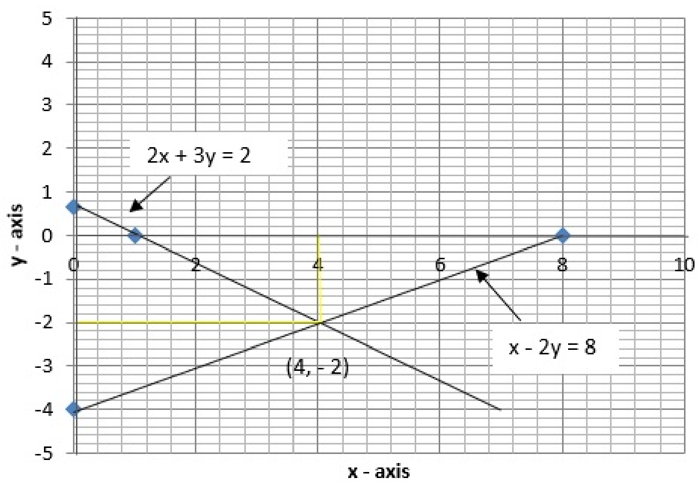
Then, take $y = 0$ and find the value of x.

x	0	1
y	2/3	0

Now similarly solve for equation, $x - 2y = 8$

x	0	8
y	- 4	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (4, - 2), which is the intersecting point of the two lines.

Question: 2

Solve each of the

Solution:

For equation, $3x + 2y = 4$

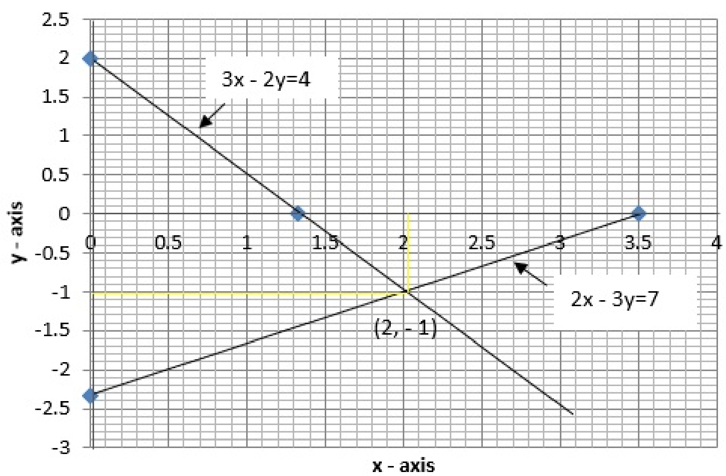
First, take x = 0 and find the value of y.

x	0	4/3
y	2	0

Now similarly solve for equation, 2x - 3y = 7

x	0	7/2
y	- 7/3	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (2, - 1), which is the intersecting point of the two lines.

Question: 3

Solve each of the

Solution:

We can rewrite the equations as:

2x + 3y = 8

x - 2y = - 3

For equation, 2x + 3y = 8

First, take x = 0 and find the value of y.

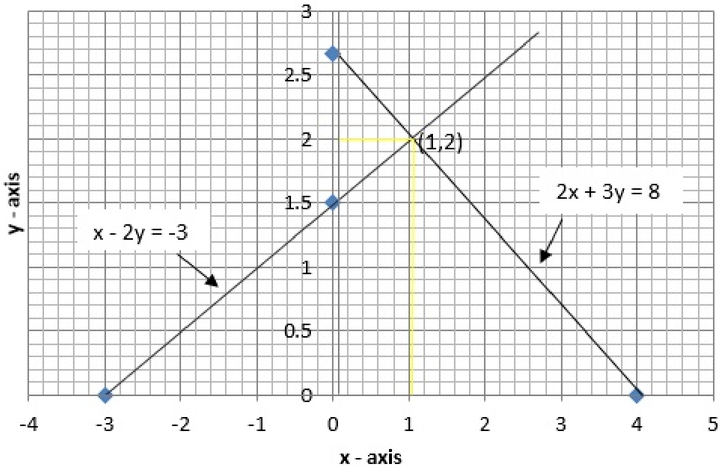
Then, take y = 0 and find the value of x.

x	0	4
y	8/3	0

Now similarly solve for equation, x - 2y = - 3

x	0	- 3
y	3/2	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (1,2), which is the intersecting point of the two lines.

Question: 4

Solve each of the

Solution:

We can rewrite the equations as:

2x – 5y = - 4

& 2x + y = 8

For equation, 2x – 5y = - 4

First, take x = 0 and find the value of y.

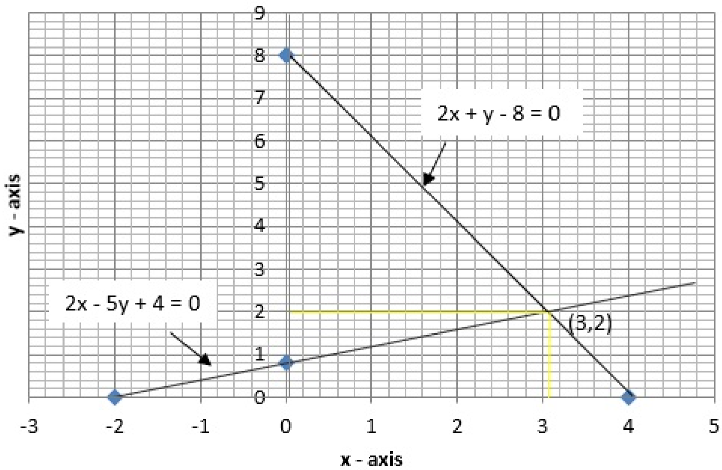
Then, take y = 0 and find the value of x.

x	0	- 2
y	4/5	0

Now similarly solve for equation, 2x + y = 8

x	0	4
y	8	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (3,2), which is the intersecting point of the two lines.

Question: 5

Solve each of the

Solution:

For equation, 3x + 2y = 12

First, take x = 0 and find the value of y.

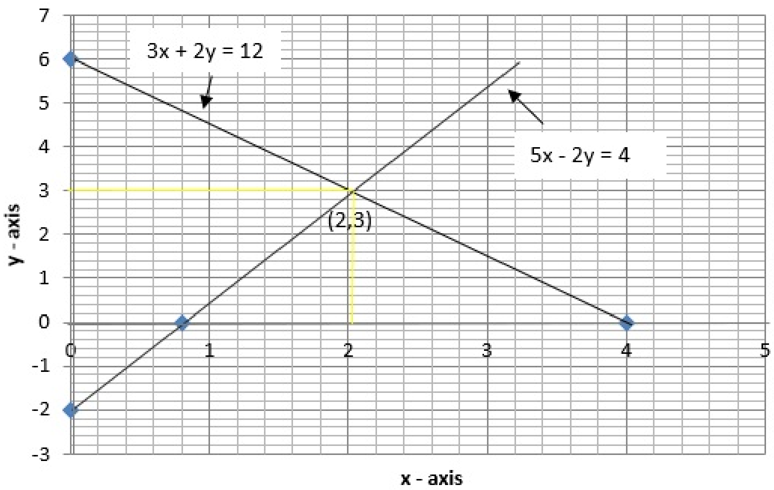
Then, take y = 0 and find the value of x.

x	0	4
y	6	0

Now similarly solve for equation, 5x – 2y = 4

x	0	4/5
y	- 2	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (2,3), which is the intersecting point of the two lines.

Question: 6

Solve each of the

Solution:

We can rewrite the equations as:

3x + y = - 1

& 2x – 3y = - 8

For equation, 3x + y = - 1

First, take x = 0 and find the value of y.

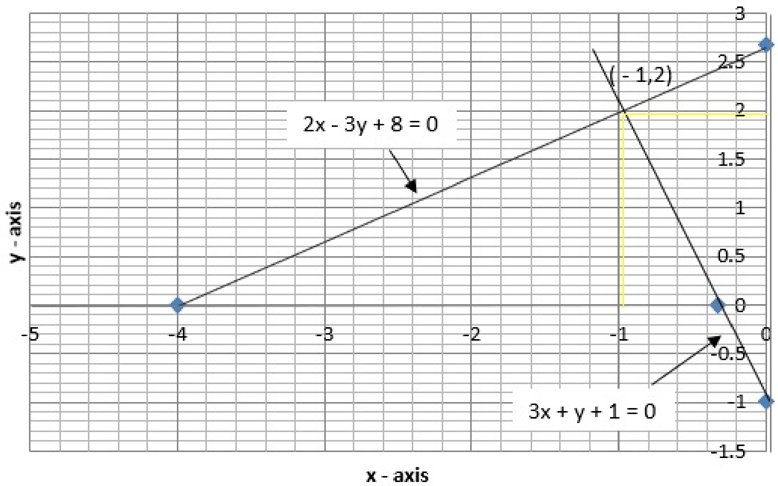
Then, take y = 0 and find the value of x.

x	0	- 1/3
y	- 1	0

Now similarly solve for equation, 2x – 3y = - 8

x	0	- 4
y	8/3	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (- 1,2), which is the intersecting point of the two lines.

Question: 7

Solve each of the

Solution:

We can rewrite the equations as:

2x + 3y = - 5

& 3x + 2y = 12

For equation, 2x + 3y = - 5

First, take x = 0 and find the value of y.

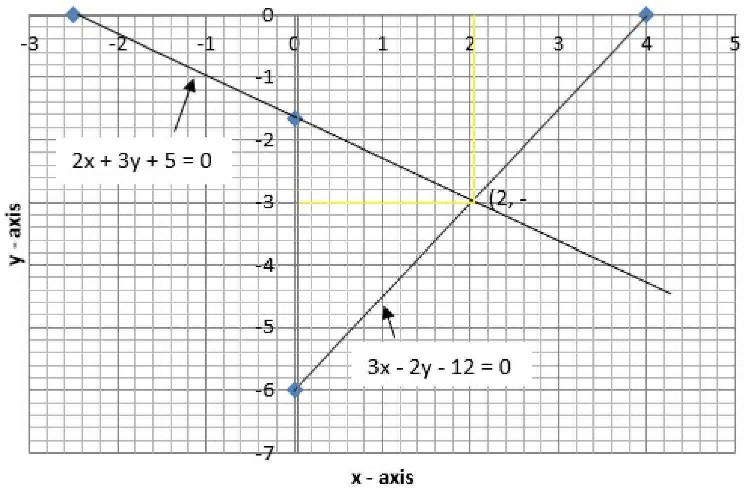
Then, take y = 0 and find the value of x.

x	0	- 5/2
y	- 5/3	0

Now similarly solve for equation, 3x + 2y = 12

x	0	4
y	- 6	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (2, - 3), which is the intersecting point of the two lines.

Question: 8

Solve each of the

Solution:

We can rewrite the equations as:

2x – 3y = - 13

& 3x – 2y = - 12

For equation, 2x – 3y = - 13

First, take x = 0 and find the value of y.

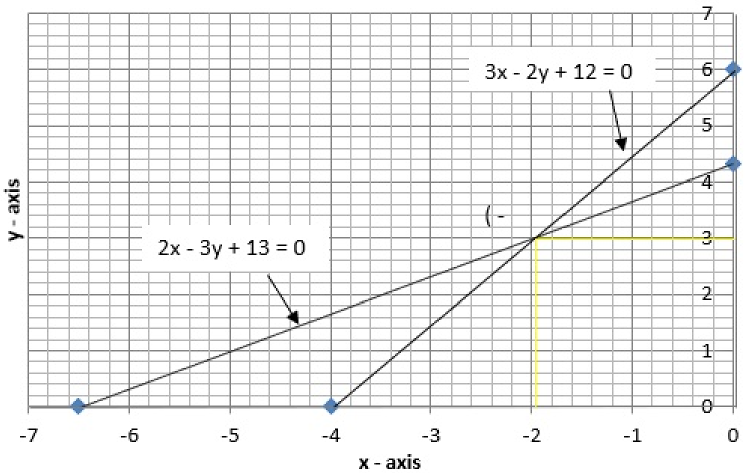
Then, take y = 0 and find the value of x.

x	0	- 13/2
y	13/3	0

Now similarly solve for equation, 3x – 2y = - 12

x	0	- 4
y	6	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (- 2,3), which is the intersecting point of the two lines.

Question: 9

Solve each of the

Solution:

We can rewrite the equations as:

2x + 3y = 4

& 3x – y = - 5

For equation, 2x + 3y = 4

First, take x = 0 and find the value of y.

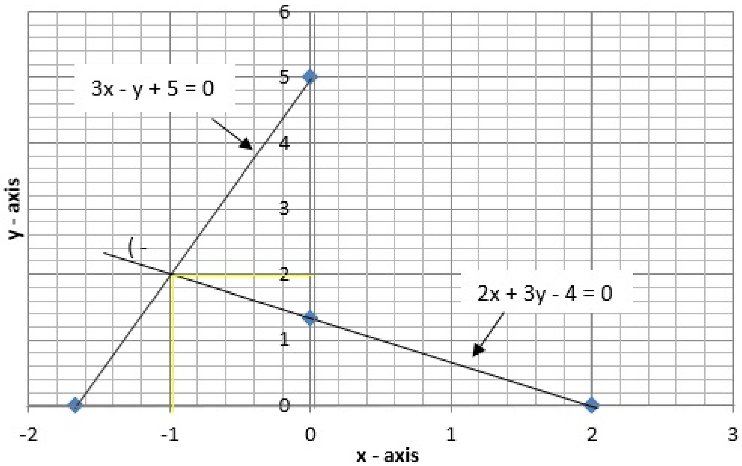
Then, take y = 0 and find the value of x.

x	0	2
y	4/3	0

Now similarly solve for equation, 3x – y = - 5

x	0	- 5/3
y	5	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (- 1,2), which is the intersecting point of the two lines.

Question: 10

Solve each of the

Solution:

We can rewrite the equations as:

x + 2y = - 2

& 3x + 2y = 2

For equation, x + 2y = - 2

First, take x = 0 and find the value of y.

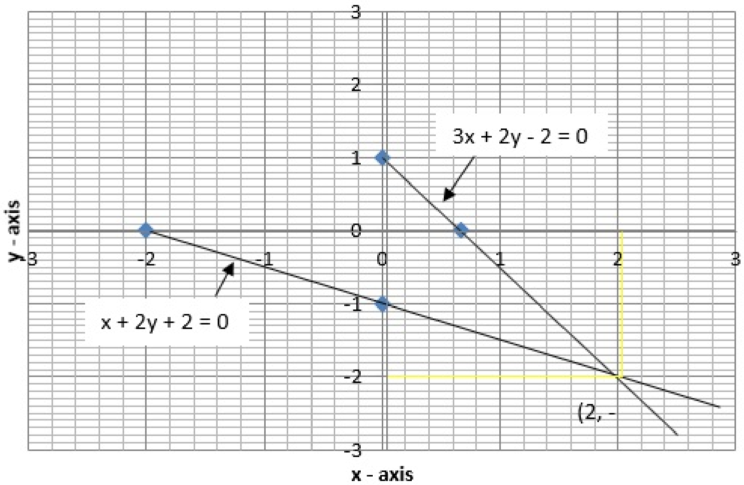
Then, take y = 0 and find the value of x.

x	0	- 2
y	- 1	0

Now similarly solve for equation, 3x + 2y = 2

x	0	2/3
y	1	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (2, - 2), which is the intersecting point of the two lines.

Question: 11

Solve each of the

Solution:

We can rewrite the equations as:

x – y = - 3

& 2x + 3y = 4

For equation, x – y = - 3

First, take x = 0 and find the value of y.

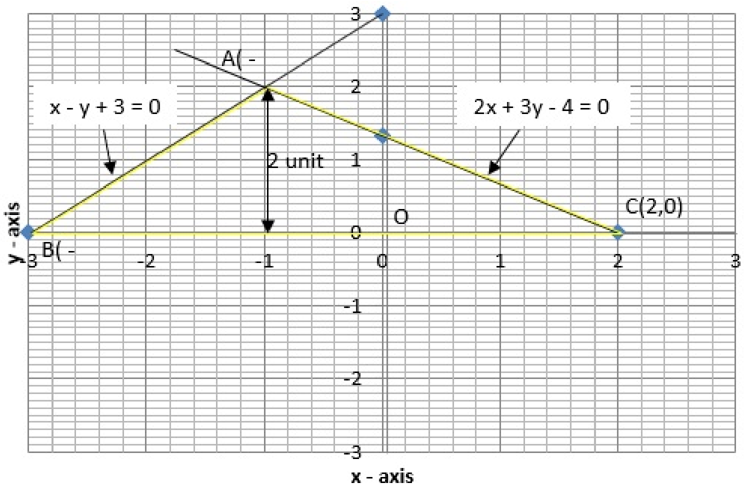
Then, take y = 0 and find the value of x.

x	0	- 3
y	3	0

Now similarly solve for equation, 2x + 3y = 4

x	0	2
y	4/3	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (- 1,2), which is the intersecting point of the two lines.

The vertices of the formed triangle ABC by these lines and the x - axis in the graph are A(- 1,2), B(- 3,0) and C(2,0).

Clearly, from the graph we can identify base and height of the triangle.

Now, we know

Area of Triangle = 1/2 × base × height

Thus, Area(ΔABC) = $\frac{1}{2} \times 5 \times 2$

[∵ Base = BO + OC = 3 + 2 = 5 units & height = 2 units]

Area(ΔABC) = 5 sq. units

Question: 12

Solve each of the

Solution:

We can rewrite the equations as:

2x – 3y = - 4

& x + 2y = 5

For equation, 2x – 3y = - 4

First, take x = 0 and find the value of y.

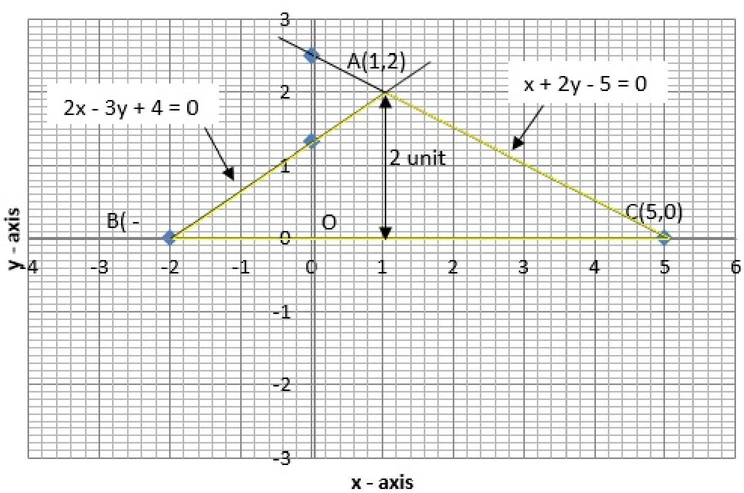
Then, take y = 0 and find the value of x.

x	0	- 2
y	4/3	0

Now similarly solve for equation, x + 2y = 5

x	0	5
y	5/2	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (1,2), which is the intersecting point of the two lines.

The vertices of the formed triangle ABC by these lines and the x - axis in the graph are A(1,2), B(-2,0) and C(5,0).

Clearly, from the graph we can identify base and height of the triangle.

Now, we know

Area of Triangle = 1/2 × base × height

Thus, Area(ΔABC) = $\frac{1}{2} \times 7 \times 2$

[∵ Base = BO + OC = 2 + 5 = 7 units & height = 2 units]

Area(ΔABC) = 7 sq. units

Question: 13

Solve each of the

Solution:

We can rewrite the equations as:

4x – 3y = - 4

& 4x + 3y = 20

For equation, 4x – 3y = - 4

First, take x = 0 and find the value of y.

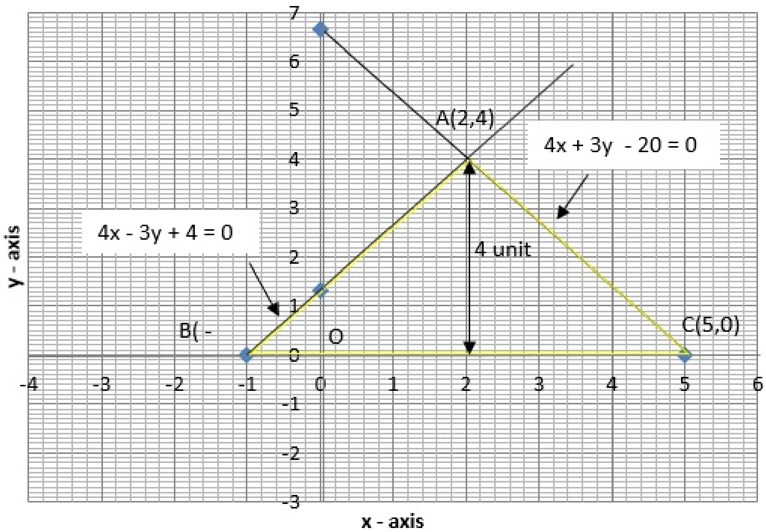
Then, take y = 0 and find the value of x.

x	0	- 1
y	4/3	0

Now similarly solve for equation, 4x + 3y = 20

x	0	5
y	20/3	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (2,4), which is the intersecting point of the two lines.

The vertices of the formed triangle ABC by these lines and the x - axis in the graph are A(2,4), B(-1,0) and C(5,0).

Clearly, from the graph we can identify base and height of the triangle.

Now, we know

Area of Triangle = 1/2 × base × height

Thus, Area(ΔABC) = $\frac{1}{2} \times 6 \times 4$

[∵ Base = BO + OC = 1 + 5 = 6 units & height = 4 units]

Area(ΔABC) = 12 sq. units

Question: 14

Solve each of the

Solution:

We can rewrite the equations as:

x – y = - 1

& 3x + 2y = 12

For equation, x – y = - 1

First, take x = 0 and find the value of y.

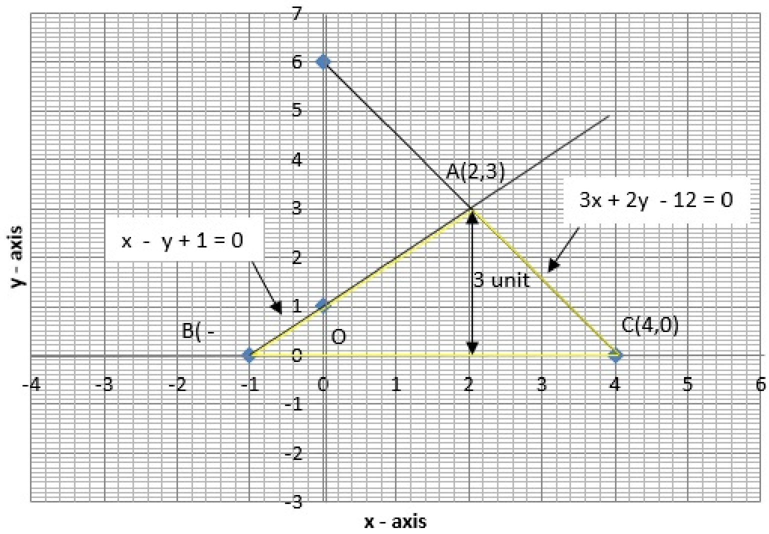
Then, take y = 0 and find the value of x.

x	0	- 1
y	- 1	0

Now similarly solve for equation, 3x + 2y = 12

x	0	4
y	6	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (2,3), which is the intersecting point of the two lines.

The vertices of the formed triangle by these lines and the x - axis in the graph are A(2,3), B(- 1,0) and C(4,0).

Clearly, from the graph we can identify base and height of the triangle.

Now, we know

Area of Triangle = 1/2 × base × height

Thus, Area(ΔABC) = $\frac{1}{2} \times 5 \times 3$

[∵ Base = BO + OC = 1 + 4 = 5 units & height = 3 units]

Area(ΔABC) = 7.5 sq. units

Question: 15

Solve each of the

Solution:

We can rewrite the equations as:

x – 2y = - 2

& 2x + y = 6

For equation, x – 2y = - 2

First, take x = 0 and find the value of y.

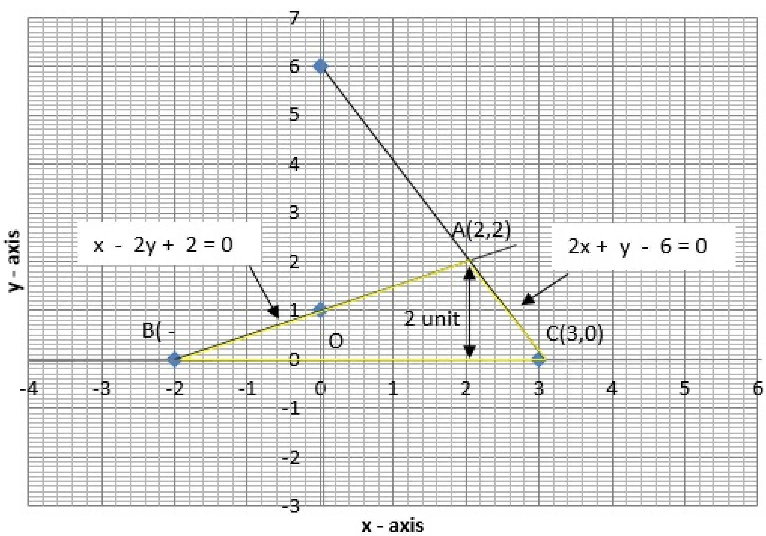
Then, take y = 0 and find the value of x.

x	0	- 2
y	1	0

Now similarly solve for equation, 2x + y = 6

x	0	3
y	6	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (2,2), which is the intersecting point of the two lines.

The vertices of the formed triangle by these lines and the x - axis in the graph are A(2,2), B(- 2,0) and C(3,0).

Clearly, from the graph we can identify base and height of the triangle.

Now, we know

Area of Triangle = 1/2 × base × height

Thus, Area(ΔABC) = 1/2 ×5×2

[∵ Base = BO + OC = 2 + 3 = 5 units & height = 2 units]

Area(ΔABC) = 2 sq. units

Question: 16

Solve each of the

Solution:

We can rewrite the equations as:

2x – 3y = - 6

& 2x + 3y = 18

For equation, 2x – 3y = - 6

First, take x = 0 and find the value of y.

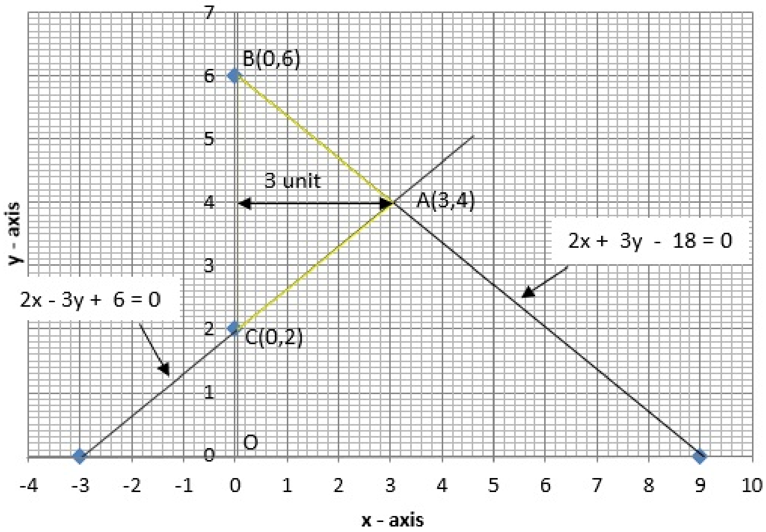
Then, take y = 0 and find the value of x.

x	0	- 3
y	2	0

Now similarly solve for equation, 2x + 3y = 18

x	0	9
y	6	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (3,4), which is the intersecting point of the two lines.

The vertices of the formed triangle by these lines and the y - axis in the graph are A(3,4), B(0,6) and C(0,2).

Clearly, from the graph we can identify base and height of the triangle.

Now, we know

Area of Triangle = 1/2 × base × height

Thus, Area(ΔABC) = $\frac{1}{2} \times 4 \times 3$

[∵ Base = OB – OC = 6 – 2 = 4 units & height = 3 units]

Area(ΔABC) = 6 sq. units

Question: 17

Solve each of the

Solution:

We can rewrite the equations as:

4x – y = 4

& 3x + 2y = 14

For equation, 4x – y = - 2

First, take x = 0 and find the value of y.

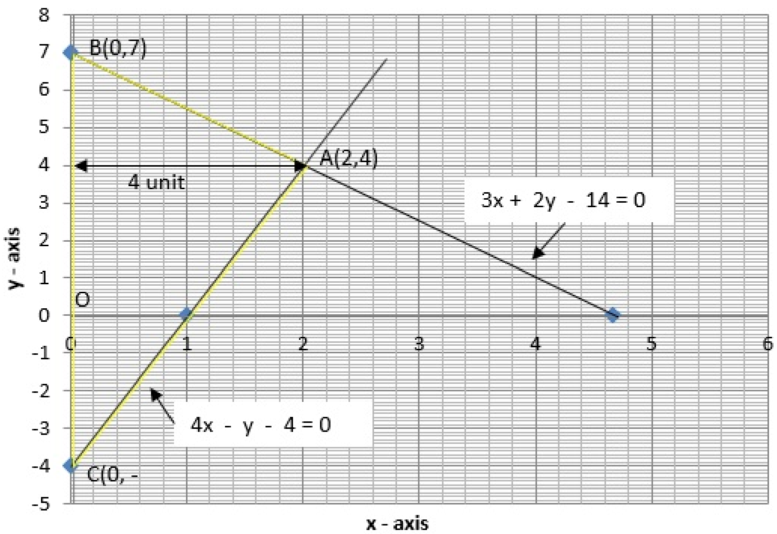
Then, take y = 0 and find the value of x.

x	0	1
y	- 4	0

Now similarly solve for equation, 3x + 2y = 14

x	0	14/3
y	7	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (2,4), which is the intersecting point of the two lines.

The vertices of the formed triangle by these lines and the y - axis in the graph are A(2,4), B(7,0) and C(0, - 4).

Clearly, from the graph we can identify base and height of the triangle.

Now, we know

Area of Triangle = 1/2 × base × height

Thus, Area(ΔABC) = $\frac{1}{2} \times 11 \times 4$

[∵ Base = OB + OC = 7 + 4 = 11 units & height = 4 units]

Area(ΔABC) = 22 sq. units

Question: 18

Solve each of the

Solution:

We can rewrite the equations as:

x – y = 5

& 3x + 5y = 15

For equation, x – y = 5

First, take x = 0 and find the value of y.

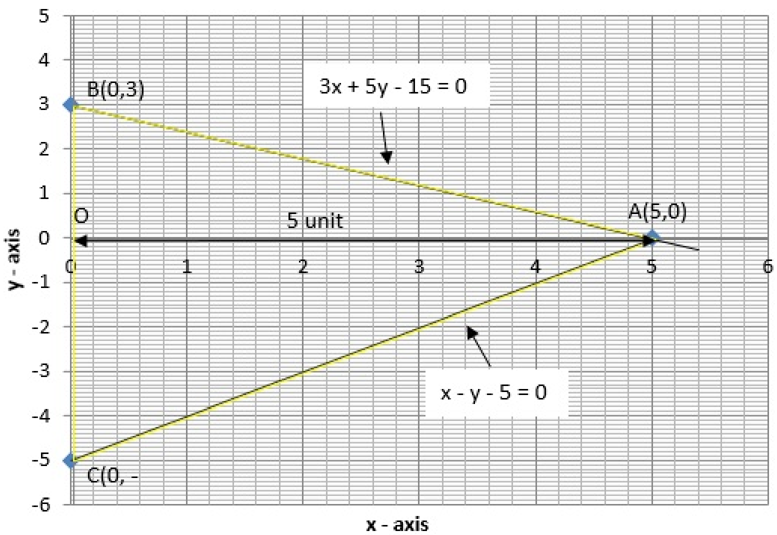
Then, take y = 0 and find the value of x.

x	0	5
y	- 5	0

Now similarly solve for equation, 3x + 5y = 15

x	0	5
y	3	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (5,0), which is the intersecting point of the two lines.

The vertices of the formed triangle by these lines and the y - axis in the graph are A(5,0), B(0,3) and C(0, - 5).

Clearly, from the graph we can identify base and height of the triangle.

Now, we know

Area of Triangle = 1/2 × base × height

Thus, Area(ΔABC) = 1/2 × 8 × 5

[∵ Base = OB + OC = 3 + 5 = 8 units & height = 5 units]

Area(ΔABC) = 20 sq. units

Question: 19

Solve each of the

Solution:

We can rewrite the equations as:

2x – 5y = - 4

& 2x + y = 8

For equation, 2x – 5y = - 4

First, take x = 0 and find the value of y.

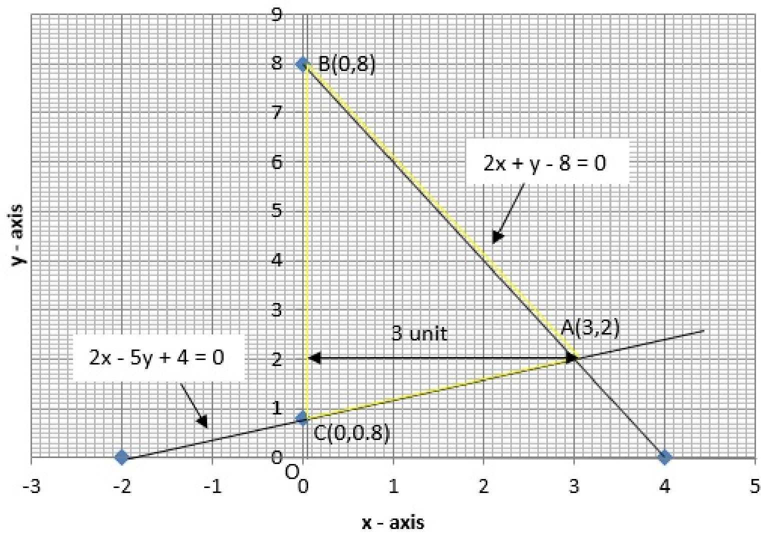
Then, take y = 0 and find the value of x.

x	0	- 2
y	4/5	0

Now similarly solve for equation, 2x + y = 8

x	0	4
y	8	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (3,2), which is the intersecting point of the two lines.

The vertices of the formed triangle by these lines and the y - axis in the graph are A(3,2), B(0,8) and C(0,0.8).

Clearly, from the graph we can identify base and height of the triangle.

Now, we know

Area of Triangle = 1/2 × base × height

Thus, Area(ΔABC) = 1/2 × 7.2 × 3

[∵ Base = OB – OC = 8 - 0.8 = 7.2 units & height = 3 units]

Area(ΔABC) = 10.8 sq. units

Question: 20

Solve each of the

Solution:

We can rewrite the equations as:

5x – y = 7

& x – y = - 1

For equation, 5x – y = 7

First, take x = 0 and find the value of y.

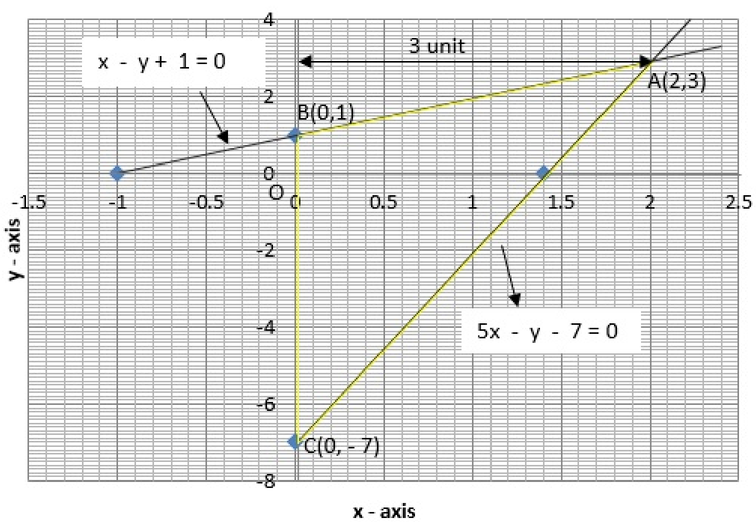
Then, take y = 0 and find the value of x.

x	0	7/5
y	- 7	0

Now similarly solve for equation, x – y = - 1

x	0	- 1
y	1	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (2,3), which is the intersecting point of the two lines.

The vertices of the formed triangle by these lines and the y - axis in the graph are A(2,3), B(0,1) and C(0, - 7).

Clearly, from the graph we can identify base and height of the triangle.

Now, we know

Area of Triangle = 1/2 × base × height

Thus, Area(ΔABC) = 1/2 × 8 × 2

[∵ Base = OB + OC = 1 + 7 = 8 units & height = 2 units from the y - axis to the point A]

Area(ΔABC) = 8 sq. units

Question: 21

Solve each of the

Solution:

We can rewrite the equations as:

2x – 3y = 12

& x + 3y = 6

For equation, 2x – 3y = 12

First, take x = 0 and find the value of y.

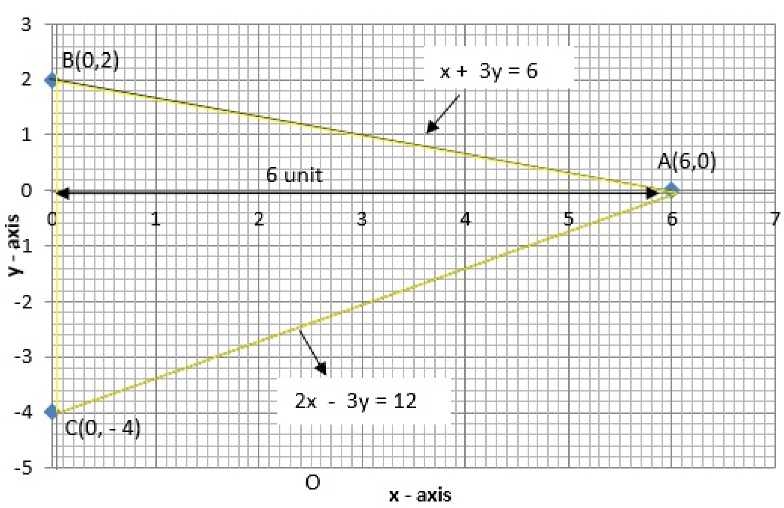
Then, take y = 0 and find the value of x.

x	0	6
y	- 4	0

Now similarly solve for equation, x + 3y = 6

x	0	6
y	2	0

Plot the values in a graph and find the intersecting point for the solution.



Hence, the solution so obtained from the graph is (6,0), which is the intersecting point of the two lines.

The vertices of the formed triangle by these lines and the y - axis in the graph are A(6,0), B(0,2) and C(0, - 4).

Clearly, from the graph we can identify base and height of the triangle.

Now, we know

Area of Triangle = 1/2 × base × height

Thus, Area(ΔABC) = 1/2 × 6 × 6

[∵ Base = OB + OC = 2 + 4 = 6 units & height = 6 units]

Area(ΔABC) = 18 sq. units

Question: 22

Show graphically

Solution:

For equation, 2x + 3y = 6

First, take x = 0 and find the value of y.

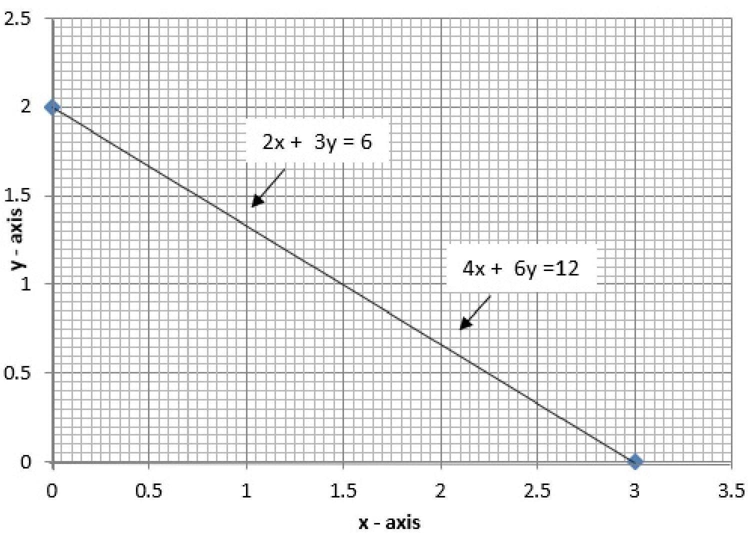
Then, take y = 0 and find the value of x.

x	0	3
y	2	0

Now similarly solve for equation, 4x + 6y = 12

x	0	3
y	2	0

Plot the values in a graph and find the intersecting point for the solution.



The lines coincide on each other, this indicates that there are number of intersection points on the line since a line consists of infinite points.

Hence, the graph shows that the system of equations have infinite number of solutions.

Question: 23

Show graphically

Solution:

For equation, 3x – y = 5

First, take x = 0 and find the value of y.

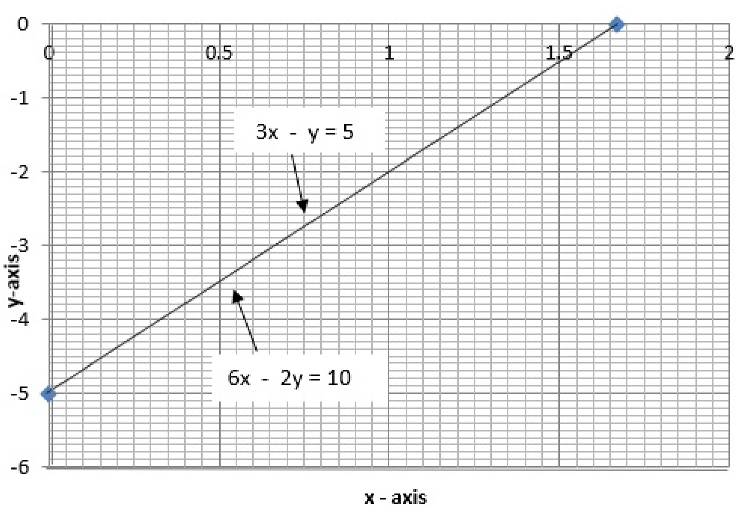
Then, take y = 0 and find the value of x.

x	0	5/3
y	- 5	0

Now similarly solve for equation, 6x - 2y = 10

x	0	5/3
y	- 5	0

Plot the values in a graph and find the intersecting point for the solution.



The lines coincide on each other, this indicates that there are number of intersection points on the line since a line consists of infinite points.

Hence, the graph shows that the system of equations have infinite number of solutions.

Question: 24

Show graphically

Solution:

For equation, 2x + y = 6

First, take x = 0 and find the value of y.

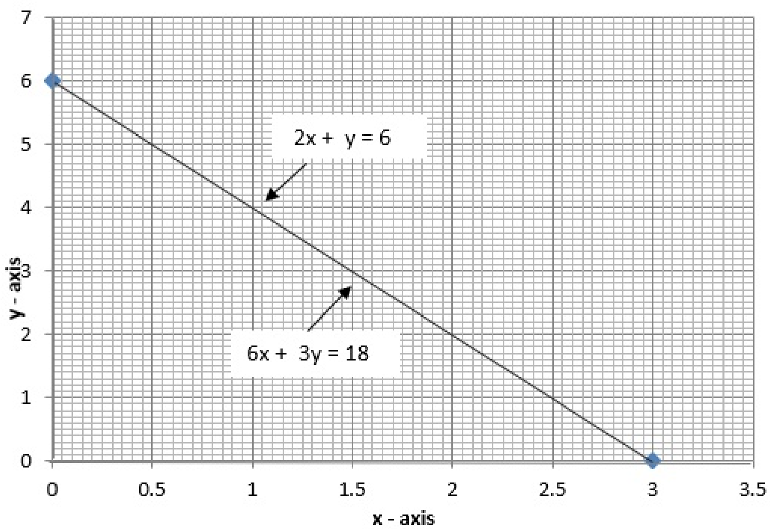
Then, take y = 0 and find the value of x.

x	0	3
y	6	0

Now similarly solve for equation, 6x + 3y = 18

x	0	3
y	6	0

Plot the values in a graph and find the intersecting point for the solution.



The lines coincide on each other, this indicates that there are number of intersection points on the line since a line consists of infinite points.

Hence, the graph shows that the system of equations have infinite number of solutions.

Question: 25

Show graphically

Solution:

For equation, x – 2y = 5

First, take x = 0 and find the value of y.

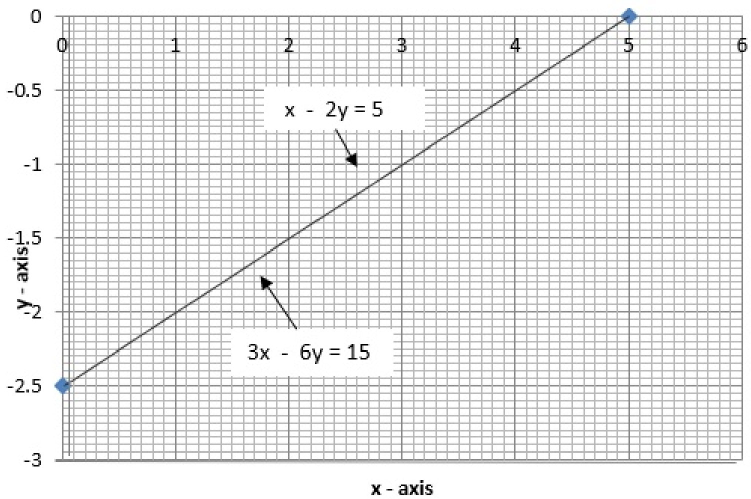
Then, take y = 0 and find the value of x.

x	0	5
y	- 5/2	0

Now similarly solve for equation, 3x – 6y = 15

x	0	5
y	- 5/2	0

Plot the values in a graph and find the intersecting point for the solution.



The lines coincide on each other, this indicates that there are number of intersection points on the line since a line consists of infinite points.

Hence, the graph shows that the system of equations have infinite number of solutions.

Question: 26

Show graphically

Solution:

For equation, x – 2y = 6

First, take x = 0 and find the value of y.

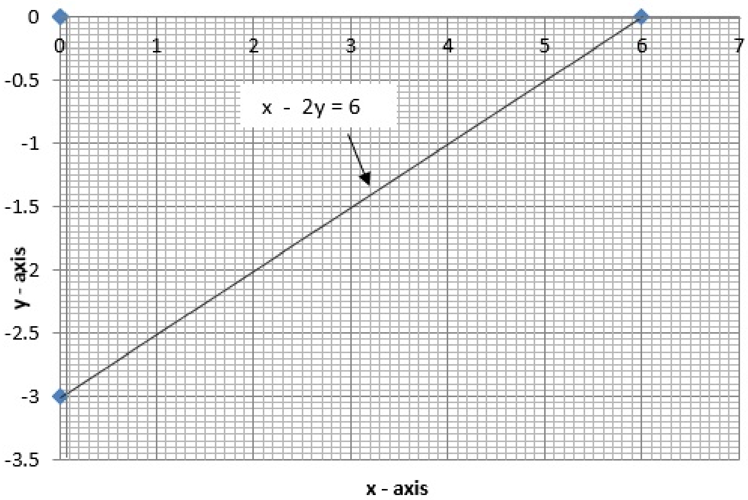
Then, take y = 0 and find the value of x.

x	0	6
y	- 3	0

Now similarly solve for equation, 3x – 6y = 0

x	0	0
y	0	0

Plot the values in a graph and find the intersecting point for the solution.



The equation line x - 2y = 6 will pass through points (0, - 3) and (6,0).

But the equation line 3x - 6y = 0 will pass through x - axis and y - axis, which does not actually intersect the line, x - 2y = 6. Hence, the graph shows that the system of equations have no solutions.

Question: 27

Show graphically

Solution:

For equation, 2x + 3y = 4

First, take x = 0 and find the value of y.

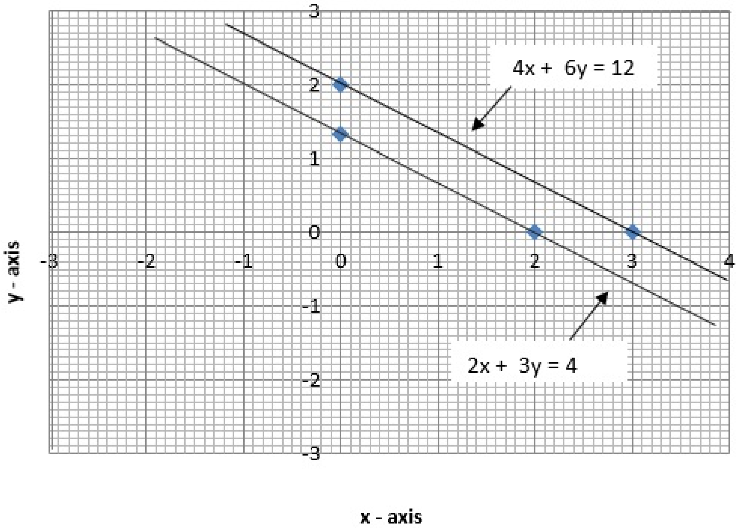
Then, take y = 0 and find the value of x.

x	0	2
y	4/3	0

Now similarly solve for equation, 4x + 6y = 12

x	0	3
y	2	0

Plot the values in a graph and find the intersecting point for the solution.



The set of equations are parallel to each other in the graph.

Parallel lines never meet each other even if they are extended.

Hence, the graph shows that the system of equations have no solutions.

Question: 28

Show graphically

Solution:

For equation, 2x + y = 6

First, take x = 0 and find the value of y.

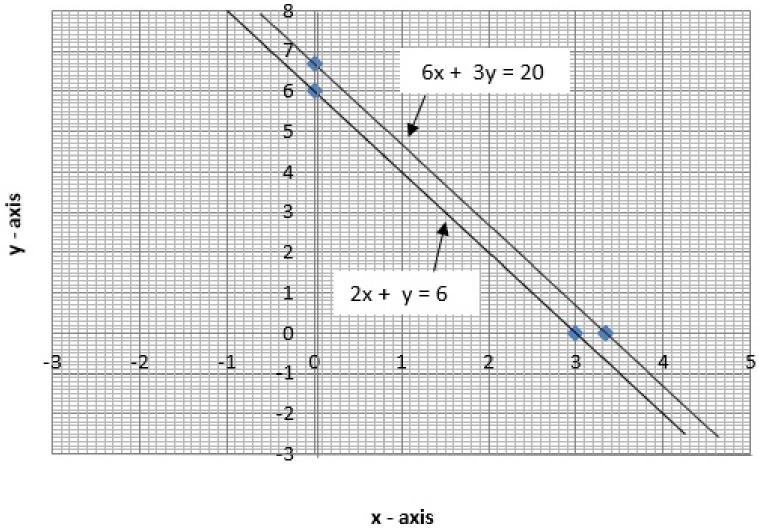
Then, take y = 0 and find the value of x.

x	0	3
y	6	0

Now similarly solve for equation, 6x + 3y = 20

x	0	10/3
y	20/3	0

Plot the values in a graph and find the intersecting point for the solution.



The set of equations are parallel to each other in the graph.

Parallel lines never meet each other even if they are extended.

Hence, the graph shows that the system of equations have no solutions.

Question: 29

Draw the graphs o

Solution:

For equation, 2x + y = 2

First, take x = 0 and find the value of y.

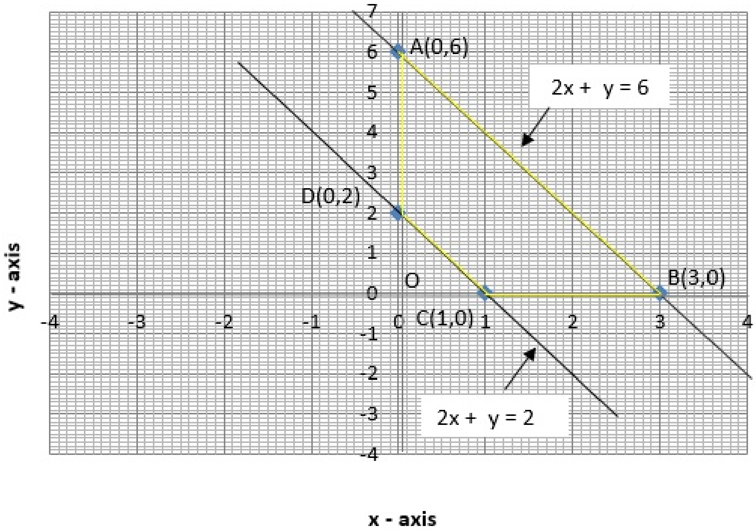
Then, take y = 0 and find the value of x.

x	0	1
y	2	0

Now similarly solve for equation, 2x + y = 6

x	0	3
y	6	0

Plot the values in a graph and find the intersecting point for the solution.



Since, the line 2x + y = 6 cuts the line y - axis at A(0,6) and x - axis at B(3,0)

& the line 2x + y = 2 cuts the x - axis at C(1,0) and y - axis at D(0,2).

Thus, it is clear from the graph that ABCD forms a trapezium.

And the coordinates joining this trapezium are (0,6),(3,0),(1,0) and (0,2).

We can find the area of trapezium ABCD.

The formula to calculate area of a trapezium ABCD is:

Area(trap. ABCD) = Area(ΔOAB) – Area(ΔOCD)

= (1/2 × 3 × 6) – (1/2 × 1 × 2)

[∵ base(ΔOAB) = 3 units & height(ΔOAB) = 6 units

= 9 - 1 base(ΔOCD) = 1 units & height(ΔOCD) = 2units]

= 8 sq. units

Exercise : 3B

Question: 1

Solve for x and y

Solution:

We have,

x + y = 3 ...eq.1

4x – 3y = 26 ...eq.2

To solve these equations, we need to make one of the variables in each equation have same coefficient.

Lets multiply eq.1 by 4, so that variable x in both the equations have same coefficient.

Recalling equations 1 & 2,

x + y = 3 [×4]

4x – 3y = 26

⇒ 4x + 4y = 12

4x – 3y = 26

On solving the two equations we get,

7y = - 14

$\Rightarrow 7y = -14$

$\Rightarrow y = -2$

Substitute y = - 2 in eq.1/eq.2, as per convenience of solving.

Thus, substituting in eq.1, we get

$x + (-2) = 3$

$\Rightarrow x = 3 + 2$

$\Rightarrow x = 5$

Hence, we have x = 5 and y = - 2.

Question: 2

Solve for x and y

Solution:

We have,

$x - y = 3$ …eq.1

$\frac{x}{3} + \frac{y}{2} = 6$ …eq.2

Let us first simplify eq.2, by taking LCM of denominator,

$\Rightarrow \frac{2x + 3y}{6} = 6$

$\Rightarrow 2x + 3y = 36$ …eq.3

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets, multiply eq.1 by 2, so that variable x in both the equations have same coefficient.

Recalling equations 1 & 2,

$x - y = 3$ [×2

$2x + 3y = 36$

$\Rightarrow 2x - 2y = 6$

$2x + 3y = 36$

On solving we get,

$\Rightarrow -5y = -30$

$\Rightarrow y = 6$

Substitute y = 6 in eq.1/eq.3, as per convenience of solving.

Thus, substituting in eq.1, we get

$x - (6) = 3$

$\Rightarrow x = 3 + 6$

$\Rightarrow x = 9$

Hence, we have x = 9 and y = 6.

Question: 3

Solve for x and y

Solution:

We have,

$2x + 3y = 0$ …eq.1

$3x + 4y = 5$ …eq.2

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets, multiply eq.1 by 3 and eq.2 by 2, so that variable x in both the equations have same coefficient.

Recalling equations 1 & 2,

$2x + 3y = 0$ [×3

$3x + 4y = 5$ [×2

$\Rightarrow 6x + 9y = 0$

$6x + 8y = 10$

On solving the two equations we get,

$y = -10$

Substitute $y = -10$ in eq.1/eq.2, as per convenience of solving.

Thus, substituting in eq.1, we get

$2x + 3(-10) = 0$

$\Rightarrow 2x = 30$

$\Rightarrow x = 15$

Hence, we have $x = 15$ and $y = -10$.

Question: 4

Solve for x and y

Solution:

We have,

$2x - 3y = 13$ …eq.1

$7x - 2y = 20$ …eq.2

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.1 by 2 and eq.2 by 3, so that variable y in both the equations have same coefficient.

Recalling equations 1 & 2,

$2x - 3y = 13$ [×2]

$7x - 2y = 20$ [×3]

$\Rightarrow 4x - 6y = 26$

$21x - 6y = 60$

On solving the two equations we get,

$-17x = -34$

$\Rightarrow x = 2$

Substitute $x = 2$ in eq.1/eq.2, as per convenience of solving.

Thus, substituting in eq.1, we get

$2(2) - 3y = 13$

$\Rightarrow -3y = 13 - 4$

$\Rightarrow -3y = 9$

$\Rightarrow y = - 3$

Hence, we have $x = 2$ and $y = - 3$.

Question: 5

Solve for x and y

Solution:

Rearranging the equations, we have

$3x – 5y = 19$ (1)

$- 7x + 3y = - 1$ (2)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply (1) by 7 and (2) by 3, so that variable x in both the equations have same coefficient.

$(3x – 5y = 19)\times 7$

$(-7x + 3y = - 1)\times 3$

$21x - 35y = 133$ (3)$-21x + 9y = -3$ (4)

adding (3) and (4), we get

$\Rightarrow -26y = 130$

$\Rightarrow y = - 5$

Substitute $y = - 5$ in (1)$3x - 5(-5) = 19 \Rightarrow 3x + 25 = 19 \Rightarrow 3x = -6 \Rightarrow x = -2$Hence, $x = -2$ and $y = -5$ is the solution of given pair of equations.

Question: 6

Solve for x and y

Solution:

Rearranging the equations, we have

$2x – y = - 3$ ...eq.1

$3x – 7y = - 10$ ...eq.2

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.1 by 7, so that variable y in both the equations have same coefficient.

Recalling equations 1 & 2,

$2x – y = - 3$ [$\times 7$

$3x – 7y = - 10$

$\Rightarrow 14x – 7y = - 21$

$3x – 7y = - 10$

On solving the above two equations we get,

$\Rightarrow 11x = - 11$

$\Rightarrow x = - 1$

Substitute $x = - 1$ in eq.1/eq.2, as per convenience of solving.

Thus, substituting in eq.1, we get

$2(- 1) – y = - 3$

$\Rightarrow - 2 – y = - 3$

⇒ y = - 2 + 3

⇒ y = 1

Hence, we have x = - 1 and y = 1.

Question: 7

Solve for x and y

Solution:

We have,

$\frac{x}{2} - \frac{y}{9} = 6$ ...eq.1

$\frac{x}{7} + \frac{y}{3} = 5$ ...eq.2

Let us first simplify eq.1 & eq.2, by taking LCM of denominators,

Eq.1 ⇒ $\frac{x}{2} - \frac{y}{9} = 6$

⇒ $\frac{9x-2y}{18} = 6$

⇒ 9x – 2y = 108 ...eq.3

Eq.2 ⇒ $\frac{x}{7} + \frac{y}{3} = 5$

⇒ $\frac{3x+7y}{21} = 5$

⇒ 3x + 7y = 105 ...eq.4

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.3 by 7 and eq.4 by 2, so that variable y in both the equations have same coefficient.

Recalling equations 3 & 4,

9x – 2y = 108 [×7

3x + 7y = 105 [×2

⇒ 63x – 14y = 756

6x + 14y = 210

On adding the above the two equations we get,

69x + 0 = 966

⇒ 69x = 966

⇒ x = 14

Substitute x = 14 in eq.3/eq.4, as per convenience of solving.

Thus, substituting in eq.4, we get

3(14) + 7y = 105

⇒ 7y = 105 - 42

⇒ 7y = 63

⇒ y = 9

Hence, we have x = 14 and y = 9.

Question: 8

Solve for x and y

Solution:

We have,

$\frac{x}{3} + \frac{y}{4} = 11$ ...eq.1

$\frac{5x}{6} - \frac{y}{3} = -7$ ...eq.2

Let us first simplify eq.1 & eq.2, by taking LCM of denominators,

Eq.1 ⇒ $\frac{x}{3} + \frac{y}{4} = 11$

⇒ $\frac{4x + 3y}{12} = 11$

⇒ 4x + 3y = 132 ...eq.3

Eq.2 ⇒ $\frac{5x}{6} - \frac{y}{3} = -7$

⇒ $\frac{5x - 2y}{6} = -7$

⇒ 5x – 2y = - 42 ...eq.4

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.3 by 2 and eq.4 by 3, so that variable y in both the equations have same coefficient.

Recalling equations 3 & 4,

4x + 3y = 132 [×2

5x – 2y = - 42 [×3

⇒ 8x + 6y = 264

15x – 6y = - 126

23x + 0 = 138

⇒ 23x = 138

⇒ x = 6

Substitute x = 6 in eq.3/eq.4, as per convenience of solving.

Thus, substituting in eq.4, we get

5(6) – 2y = - 42

⇒ 30 – 2y = - 42

⇒ 2y = 30 + 42

⇒ 2y = 72

⇒ y = 36

Hence, we have x = 6 and y = 36.

Question: 9

Solve for x and y

Solution:

We have,

4x – 3y = 8 ...eq.1

$6x - y = \frac{29}{3}$ ...eq.2

Let us first simplify eq.2 by taking LCM of denominator,

Eq.2 ⇒ $6x - y = \frac{29}{3}$

⇒ $18x - 3y = 29$ ...eq.3

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

And it is so that the equations 1 & 3 have variable y having same coefficient already, so we need not multiply or divide it with any number.

Recalling equations 1 & 3,

$4x - 3y = 8$

$18x - 3y = 29$

⇒ $4x - 3y = 8$

$18x - 3y = 29$

On solving the above equations we get,

⇒ $-14x = -21$

⇒ $x = \frac{21}{14}$

⇒ $x = \frac{3}{2}$

Substitute $x = \frac{3}{2}$ in eq.1/eq.3, as per convenience of solving.

Thus, substituting in eq.1, we get

$4\left(\frac{3}{2}\right) - 3y = 8$

⇒ $6 - 3y = 8$

⇒ $3y = 6 - 8$

⇒ $3y = -2$

⇒ $y = -\frac{2}{3}$

Hence, we have $x = \frac{3}{2}$ and $y = -\frac{2}{3}$

Question: 10

Solve for x and y

Solution:

We have,

$2x - \frac{3y}{4} = 3$ ...eq.1

$5x = 2y + 7$ or $5x - 2y = 7$ ...eq.2

Let us first simplify eq.1 by taking LCM of denominator,

Eq.2 ⇒ $2x - \frac{3y}{4} = 3$

⇒ $8x - 3y = 12$ ...eq.3

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.2 by 3 and eq.3 by 2, so that variable y in both the equations have same coefficient.

Recalling equations 2 & 3,

$5x - 2y = 7$ [×3]

$8x - 3y = 12$ [×2]

$\Rightarrow 15x - 6y = 21$

$16x - 6y = 24$

On solving the above equations we get,

$- x - 0 = - 3$

$\Rightarrow - x = - 3$

$\Rightarrow x = 3$

Substitute x = 3 in eq.2/eq.3, as per convenience of solving.

Thus, substituting in eq.2, we get

$5(3) - 2y = 7$

$\Rightarrow 15 - 2y = 7$

$\Rightarrow 2y = 15 - 7$

$\Rightarrow 2y = 8$

$\Rightarrow y = 4$

Hence, we have x = 3 and y = 4

Question: 11

Solve for x and y

Solution:

We have,

$2x + 5y = \frac{8}{3}$ …eq.1

$3x - 2y = \frac{5}{6}$ …eq.2

Let us first simplify eq.1 & eq.2 by taking LCM of denominators,

Eq.1 → $2x + 5y = \frac{8}{3}$

$\Rightarrow 6x + 15y = 8$ …eq.3

Eq.2 → $3x - 2y = \frac{5}{6}$

$\Rightarrow 18x - 12y = 5$ …eq 4

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.3 by 18 and eq.4 by 6, so that variable x in both the equations have same coefficient.

Recalling equations 3 & 4,

$6x + 15y = 8$ [×18]

$18x - 12y = 5$ [×6]

$\Rightarrow 108x + 270y = 144$

$108x - 72y = 30$

On solving these two equations we get,

$\Rightarrow$ 342y = 114

$\Rightarrow y = \frac{114}{342}$

$\Rightarrow y = \frac{1}{3}$

Substitute $y = \frac{1}{3}$ in eq.3/eq.4, as per convenience of solving.

Thus, substituting in eq.3, we get

$6x + 15\left(\frac{1}{3}\right) = 8$

$\Rightarrow$ 6x + 5 = 8

$\Rightarrow$ 6x = 8 – 5

$\Rightarrow$ 6x = 3

$\Rightarrow x = \frac{1}{2}$

Hence, we have $x = \frac{1}{2}$ and $y = \frac{1}{3}$

Question: 12

Solve for x and y

Solution:

After rearrangement, we have

2x + 3y = - 1 ...eq.1

$\frac{7-4x}{3} = y$ ...eq.2

Let us first simplify eq.2 by taking LCM of denominator,

Eq.1 $\Rightarrow \frac{7-4x}{3} = y$

$\Rightarrow$ 7 – 4x = 3y

$\Rightarrow$ 4x + 3y = 7 ...eq.3

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

And it is so that the equations 1 & 3 have variable y having same coefficient already, so we need not multiply or divide it with any number.

Recalling equations 1 & 3,

2x + 3y = - 1

4x + 3y = 7

On solving these two equations we get,

$\Rightarrow$ x = 4

Substitute x = 4 in eq.1/eq.3, as per convenience of solving.

Thus, substituting in eq.3, we get

4(4) + 3y = 7

$\Rightarrow$ 16 + 3y = 7

$\Rightarrow$ 3y = 7 – 16

$\Rightarrow$ 3y = - 9

$\Rightarrow$ y = - 3

Hence, we have x = 4 and y = - 3

Question: 13

Solve for x and y

Solution:

We have

0.4x + 0.3y = 1.7

0.7x – 0.2y = 0.8

Lets simplify these equations. We can rewrite them as,

$$\frac{4}{10}x + \frac{3}{10}y = \frac{17}{10}$$

⇒ 4x + 3y = 17 …eq.1

$$\frac{7}{10}x - \frac{2}{10}y = \frac{8}{10}$$

⇒ 7x – 2y = 8 …eq.2

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.1 by 2 & eq.2 by 3, so that variable y in both the equations have same coefficient.

Recalling equations 1 & 2,

4x + 3y = 17 , on multiplying equation with 2

7x – 2y = 8 , on multiplying equation with 3

We get,

8x + 6y = 34

21x – 6y = 24

On solving the equation, we get,

x = 2

Substitute x = 2 in eq.1/eq.2, as per convenience of solving.

Thus, substituting in eq.2, we get

7(2) – 2y = 8

⇒ 14 – 2y = 8

⇒ 2y = 14 – 8

⇒ 2y = 6

⇒ y = 3

Hence, we have x = 2 and y = 3.

Question: 14

Solve for x and y

Solution:

We have

0.3x + 0.5y = 0.5

0.5x + 0.7y = 0.74

Lets simplify these equations. We can rewrite them as,

$$\frac{3}{10}x + \frac{5}{10}y = \frac{5}{10}$$

⇒ 3x + 5y = 5 …(i)

$$\frac{5}{10}x + \frac{7}{10}y = \frac{74}{100}$$

⇒ 50x + 70y = 74 …(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply equation (i) by 14, so that variable y in both the equations have same coefficient.

Recalling equations (i) & (ii),

3x + 5y = 5 [×14

50x + 70y = 74

$$\begin{array}{rrrr} \Rightarrow & 42x + 70y = 70 \\ & 50x + 70y = 74 \\ & (-) \quad (-) \quad\quad (-) \\ \hline & -8x + 0 = -4 \\ \hline \end{array}$$

⇒ - 8x = - 4

$\Rightarrow x = \frac{4}{8}$

$\Rightarrow x = \frac{1}{2}$

⇒ x = 0.5

Substitute $x = \frac{1}{2}$ in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in equation (i), we get

$$3\left(\frac{1}{2}\right) + 5y = 5$$

$\Rightarrow \frac{3}{2} + 5y = 5$

⇒ 3 + 10y = 10

⇒ 10y = 10 – 3

⇒ 10y = 7

$\Rightarrow y = \frac{7}{10}$

⇒ y = 0.7

Hence, we have x = 0.5 and y = 0.7

Question: 15

Solve for x and y

Solution:

We have

7(y + 3) – 2(x + 2) = 14

4(y – 2) + 3(x – 3) = 2

Lets simplify these equations. We can rewrite them,

$7(y + 3) - 2(x + 2) = 14$

$\Rightarrow 7y + 21 - 2x - 4 = 14$

$\Rightarrow 7y - 2x + 17 = 14$

$\Rightarrow 2x - 7y = 3$ ...(i)

$4(y - 2) + 3(x - 3) = 2$

$\Rightarrow 4y - 8 + 3x - 9 = 2$

$\Rightarrow 3x + 4y - 17 = 2$

$\Rightarrow 3x + 4y = 19$ ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 3 and eq.(ii) by 2, so that variable x in both the equations have same coefficient.

Recalling equations (i) & (ii),

$2x - 7y = 3$ [×3

$3x + 4y = 19$ [×2

$$\begin{array}{l} 6x - 21y = 9 \\ 6x + 8y = 38 \\ (-) \quad (-) \quad (-) \\ \hline 0 - 29y = -29 \\ \hline \end{array}$$

$\Rightarrow -29y = -29$

$\Rightarrow y = 1$

Substitute y = 1 in eq.(i) or eq.(ii), as per convenience of solving.

Thus, substituting in equation (i), we get

$2x - 7(1) = 3$

$\Rightarrow 2x - 7 = 3$

$\Rightarrow 2x = 7 + 3$

$\Rightarrow 2x = 10$

$\Rightarrow x = 5$

Hence, we have x = 5 and y = 1

Question: 16

Solve for x and y

Solution:

Since, if $a = b = c \Rightarrow a = b$ & $b = c$

Thus, we have

$6x + 5y = 7x + 3y + 1$

$2(x + 6y - 1) = 7x + 3y + 1$

Lets simplify these equations. We can rewrite them,

$6x + 5y = 7x + 3y + 1$

$\Rightarrow 7x - 6x + 3y - 5y = -1$

$\Rightarrow x - 2y = -1$ ...(i)

$2(x + 6y - 1) = 7x + 3y + 1$

$\Rightarrow 2x + 12y - 2 = 7x + 3y + 1$

$\Rightarrow 7x - 2x + 3y - 12y = - 2 - 1$

$\Rightarrow 5x - 9y = - 3$ ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 5, so that variable x in both the equations have same coefficient.

Recalling equations (i) & (ii),

$x - 2y = - 1$ [×5

$5x - 9y = - 3$

$$\begin{array}{r}
5x - 10y = -5 \\
5x - 9y = -3 \\
(-) \quad (-) \quad (-) \\
\hline
0 - y = -2 \\
\hline
\end{array}$$

$\Rightarrow - y = - 2$

$\Rightarrow y = 2$

Substitute y = 2 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

$x - 2(2) = - 1$

$\Rightarrow x - 4 = - 1$

$\Rightarrow x = - 1 + 4$

$\Rightarrow x = 3$

Hence, we have x = 3 and y = 2

Question: 17

Solve for x and y

Solution:

Since, if $a = b = c \Rightarrow a = b$ & $b = c$

Thus, we have

$$\frac{x + y - 8}{2} = \frac{x + 2y - 14}{3}$$

and $\frac{3x + y - 12}{11} = \frac{x + 2y - 14}{3}$

Lets simplify these equations. We can rewrite them,

$$\frac{x + y - 8}{2} = \frac{x + 2y - 14}{3}$$

$\Rightarrow 3(x + y - 8) = 2(x + 2y - 14)$

$\Rightarrow 3x + 3y - 24 = 2x + 4y - 28$

$\Rightarrow 3x - 2x + 3y - 4y = - 28 + 24$

$\Rightarrow x - y = - 4$ ...(i)

$$\frac{3x + y - 12}{11} = \frac{x + 2y - 14}{3}$$

$\Rightarrow 3(3x + y - 12) = 11(x + 2y - 14)$

$\Rightarrow 9x + 3y - 36 = 11x + 22y - 154$

$\Rightarrow 11x - 9x + 22y - 3y = 154 - 36$

$\Rightarrow 2x + 19y = 118$ ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 19, so that variable y in both the equations have same coefficient.

Recalling equations (i) & (ii),

$x - y = -4$ [×19

$2x + 19y = 118$

$$\begin{array}{r} 19x - 19y = -76 \\ 2x + 19y = 118 \\ (-)\quad (-)\quad\quad (-) \\ \hline 21x + 0 = 42 \\ \hline \end{array}$$

$\Rightarrow 21x = 42$

$\Rightarrow x = 2$

Substitute x = 2 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

$2 - y = -4$

$\Rightarrow y = 2 + 4$

$\Rightarrow y = 6$

Hence, we have x = 2 and y = 6

Question: 18

Solve for x and y

Solution:

We have

$$\frac{5}{x} + 6y = 13$$

and $\frac{3}{x} + 4y = 7$

Lets simplify these equations. Assuming 1/x = z, we can rewrite them,

$$\frac{5}{x} + 6y = 13$$

$\Rightarrow 5z + 6y = 13$ ...(i)

$$\frac{3}{x} + 4y = 7$$

$\Rightarrow 3z + 4y = 7$ ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 3 and eq.(ii) by 5, so that variable z in both the equations have same coefficient.

Recalling equations (i) & (ii),

$5z + 6y = 13$ [×3

$3z + 4y = 7$ [×5

$$\begin{array}{l} 15z + 18y = 39 \\ 15z + 20y = 35 \\ (-)\quad (-)\quad\quad (-) \\ \hline 0 - 2y = 4 \\ \hline \end{array}$$

⇒ $-2y = 4$

⇒ $y = -2$

Substitute $y = -2$ in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(ii), we get

$3z + 4(-2) = 7$

⇒ $3z - 8 = 7$

⇒ $3z = 7 + 8$

⇒ $3z = 15$

⇒ $z = 5$

Thus, $z = 5$ and $y = -2$

As $z = 1/x$,

⇒ $5 = 1/x$

⇒ $x = 1/5$

Hence, we have $x = 1/5$ and $y = -2$

Question: 19

Solve for x and y

Solution:

We have

$$x + \frac{6}{y} = 6$$

and $3x - \frac{8}{y} = 5$

Lets simplify these equations. Assuming $1/y = z$, we can rewrite them,

$$x + \frac{6}{y} = 6$$

⇒ $x + 6z = 6$ …(i)

$$3x - \frac{8}{y} = 5$$

⇒ $3x - 8z = 5$ …(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 3, so that variable “x” in both the equations have same coefficient.

Recalling equations (i) & (ii),

$x + 6z = 6$ [×3

$3x - 8z = 5$

$$\begin{array}{r} 3x + 18z = 18 \\ 3x - 8z = 5 \\ (-) \quad (+) \quad (-) \\ \hline 0 + 26z = 13 \end{array}$$

⇒ 26z = 13

⇒ z = 13/26

⇒ z = 1/2

Substitute z = 1/2 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

x + 6(1/2) = 6

⇒ x + 3 = 6

⇒ x = 3

Thus, z = 1/2 and x = 3

As z = 1/y,

⇒ $\frac{1}{2} = \frac{1}{y}$

⇒ y = 2

Hence, we have x = 3 and y = 2

Question: 20

Solve for x and y

Solution:

We have

$2x - \frac{3}{y} = 9$

and $3x + \frac{7}{y} = 2$

where y≠0

Lets simplify these equations. Assuming 1/y = z, we can rewrite them,

$2x - \frac{3}{y} = 9$

⇒ 2x – 3z = 9 …(i)

$3x + \frac{7}{y} = 2$

⇒ 3x + 7z = 2 …(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 3 and eq.(ii) by 2, so that variable x in both the equations have same coefficient.

Recalling equations (i) & (ii),

2x – 3z = 9 [×3

3x + 7z = 2 [×2

$$\begin{array}{l} 6x - 9z = 27 \\ 6x + 14z = 4 \\ (-) \quad (-) \quad (-) \\ \hline 0 - 23z = 23 \\ \hline \end{array}$$

⇒ - 23z = 23

⇒ z = - 1

Substitute z = - 1 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

2x – 3(- 1) = 9

⇒ 2x + 3 = 9

⇒ 2x = 6

⇒ x = 3

Thus, z = - 1 and x = 3

As z = 1/y,

⇒ - 1 = 1/y

⇒ y = - 1

Hence, we have x = 3 and y = - 1

Question: 21

Solve for x and y

Solution:

We have

$$\frac{3}{x} - \frac{1}{y} + 9 = 0$$

and $\frac{2}{x} + \frac{3}{y} = 5$

where x≠0 and y≠0

Lets simplify these equations. Assuming 1/x = p and 1/y = q, we can rewrite them,

$$\frac{3}{x} - \frac{1}{y} + 9 = 0$$

⇒ 3p – q = - 9 …(i)

$$\frac{2}{x} + \frac{3}{y} = 5$$

⇒ 2p + 3q = 5 …(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 3, so that variable q in both the equations have same coefficient.

Recalling equations (i) & (ii),

3p – q = - 9 [×3

2p + 3q = 5

$$\begin{array}{l} 9p - 3q = -27 \\ 2p + 3q = 5 \\ \hline 11p + 0 = -22 \\ \hline \end{array}$$

$\Rightarrow 11p = -22$

$\Rightarrow p = -2$

Substitute p = - 2 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

$3(-2) - q = -9$

$\Rightarrow -6 - q = -9$

$\Rightarrow q = 9 - 6$

$\Rightarrow q = 3$

Thus, p = - 2 and q = 3

As p = 1/x,

$\Rightarrow -2 = 1/x$

$\Rightarrow x = -1/2$

And q = 1/y

$\Rightarrow 3 = 1/y$

$\Rightarrow y = 1/3$

Hence, we have x = - 1/2 and y = 1/3

Question: 22

Solve for x and y

Solution:

We have

$$\frac{9}{x} - \frac{4}{y} = 8$$

and $\frac{13}{x} + \frac{7}{y} = 101$

where $x \neq 0$ and $y \neq 0$

Lets simplify these equations. Assuming 1/x = p and 1/y = q, we can rewrite them,

$$\frac{9}{x} - \frac{4}{y} = 8$$

$\Rightarrow 9p - 4q = 8$ …(i)

$$\frac{13}{x} + \frac{7}{y} = 101$$

$\Rightarrow 13p + 7q = 101$ …(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 7 and eq.(ii) by 4, so that variable q in both the equations have same coefficient.

Recalling equations (i) & (ii),

9p – 4q = 8 [×7

13p + 7q = 101 [×4

$$\begin{array}{r} 63p - 28q = 56 \\ 52p + 28q = 404 \\ \hline 115p + 0 = 460 \\ \hline \end{array}$$

⇒ 115p = 460

⇒ p = 4

Substitute p = 4 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

9(4) – 4q = 8

⇒ 36 – 4q = 8

⇒ 4q = 36 – 8 = 28

⇒ q = 7

Thus, p = 4 and q = 7

As p = 1/x,

⇒ 4 = 1/x

⇒ x = 1/4

And q = 1/y

⇒ 7 = 1/y

⇒ y = 1/7

Hence, we have x = 1/4 and y = 1/7

Question: 23

Solve for x and y

Solution:

We have

$$\frac{5}{x} - \frac{3}{y} = 1$$

and $\frac{3}{2x} + \frac{2}{3y} = 5$

where x≠0 and y≠0

Lets simplify these equations. Assuming 1/x = p and 1/y = q, we can rewrite them,

$$\frac{5}{x} - \frac{3}{y} = 1$$

⇒ 5p – 3q = 1 ...(i)

$$\frac{3}{2x} + \frac{2}{3y} = 5$$

⇒ $\frac{3p}{2} + \frac{2q}{3} = 5$

⇒ 9p + 4q = 30 ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 4 and eq.(ii) by 3, so that variable q in both the equations have same coefficient.

Recalling equations (i) & (ii),

5p – 3q = 1 [×4

9p + 4q = 30 [×3

$$\begin{array}{r} 20p - 12q = 4 \\ 27p + 12q = 90 \\ \hline 47p + 0 = 94 \\ \hline \end{array}$$

⇒ 47p = 94

⇒ p = 2

Substitute p = 2 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

5(2) – 3q = 1

⇒ 10 – 3q = 1

⇒ 3q = 10 – 1 = 9

⇒ q = 3

Thus, p = 2 and q = 3

As p = 1/x,

⇒ 2 = 1/x

⇒ x = 1/2

And q = 1/y

⇒ 3 = 1/y

⇒ y = 1/3

Hence, we have x = 1/2 and y = 1/3

Question: 24

Solve for x and y

Solution:

We have

$$\frac{1}{2x} + \frac{1}{3y} = 2$$

and $\frac{1}{3x} + \frac{1}{2y} = \frac{13}{6}$

where x≠0 and y≠0

Lets simplify these equations. Assuming 1/x = p and 1/y = q, we can rewrite them,

$$\frac{1}{2x} + \frac{1}{3y} = 2$$

⇒ 3p + 2q = 12 ...(i)

$$\frac{1}{3x} + \frac{1}{2y} = \frac{13}{6}$$

$\Rightarrow 2p + 3q = 13$ …(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 2 and eq.(ii) by 3, so that variable p in both the equations have same coefficient.

Recalling equations (i) & (ii),

$3p + 2q = 12$ [×2

$2p + 3q = 13$ [×3

$$\begin{array}{rcl} 6p + 4q &=& 24 \\ 6p + 9q &=& 39 \\ (-)\quad (-) & & (-) \\ \hline 0 - 5q &=& -15 \\ \hline \end{array}$$

$\Rightarrow -5q = -15$

$\Rightarrow q = 3$

Substitute $q = 3$ in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

$3p + 2(3) = 12$

$\Rightarrow 3p + 6 = 12$

$\Rightarrow 3p = 12 - 6 = 6$

$\Rightarrow p = 2$

Thus, $p = 2$ and $q = 3$

As $p = 1/x$,

$\Rightarrow 2 = 1/x$

$\Rightarrow x = 1/2$

And $q = 1/y$

$\Rightarrow 3 = 1/y$

$\Rightarrow y = 1/3$

Hence, we have $x = 1/2$ and $y = 1/3$

Question: 25

Solve for x and y

Solution:

We have

$4x + 6y = 3xy$

and $8x + 9y = 5xy$

where $x \neq 0$ and $y \neq 0$

Lets simplify these equations.

$4x + 6y = 3xy$

Dividing the equation by xy throughout,

$$\frac{4x}{xy} + \frac{6y}{xy} = \frac{3xy}{xy}$$

$\Rightarrow \frac{4}{y} + \frac{6}{x} = 3$

Assuming p = 1/y and q = 1/x, we get

4p + 6q = 3 …(i)

Also, 8x + 9y = 5xy

Dividing the equation by xy throughout,

$$\frac{8x}{xy} + \frac{9y}{xy} = \frac{5xy}{xy}$$

$\Rightarrow \frac{8}{y} + \frac{9}{x} = 5$

Assuming p = 1/y and q = 1/x, we get

⇒ 8p + 9q = 5 …(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 2, so that variable p in both the equations have same coefficient.

Recalling equations (i) & (ii),

4p + 6q = 3 [×2

8p + 9q = 5

$$\begin{array}{r} 8p + 12q = 6 \\ 8p + 9q = 5 \\ (-) \quad (-) \quad (-) \\ \hline 0 + 3q = 1 \\ \hline \end{array}$$

⇒ 3q = 1

⇒ q = 1/3

Substitute q = 1/3 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

4p + 6(1/3) = 3

⇒ 4p + 2 = 3

⇒ 4p = 3 – 2 = 1

⇒ p = 1/4

Thus, p = 1/4 and q = 1/3

As q = 1/x,

⇒ 1/3 = 1/x

⇒ x = 3

And p = 1/y

⇒ 1/4 = 1/y

⇒ y = 4

Hence, we have x = 3 and y = 4

Question: 26

Solve for x and y

Solution:

We have

x + y = 5xy

and 3x + 2y = 13xy

where x≠0 and y≠0

Lets simplify these equations.

x + y = 5xy

Dividing the equation by xy throughout,

$$\frac{x}{xy} + \frac{y}{xy} = \frac{5xy}{xy}$$

$$\Rightarrow \frac{1}{y} + \frac{1}{x} = 5$$

Assuming p = 1/y and q = 1/x, we get

p + q = 5 ...(i)

Also, 3x + 2y = 13xy

Dividing the equation by xy throughout,

$$\frac{3x}{xy} + \frac{2y}{xy} = \frac{13xy}{xy}$$

$$\Rightarrow \frac{3}{y} + \frac{2}{x} = 13$$

Assuming p = 1/y and q = 1/x, we get

⇒ 3p + 2q = 13 ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 2, so that variable q in both the equations have same coefficient.

Recalling equations (i) & (ii),

p + q = 5 [×2]

3p + 2q = 13

$$\begin{array}{r} 2p + 2q = 10 \\ 3p + 2q = 13 \\ (-)\quad (-)\quad\ (-) \\ \hline -p + 0 = -3 \\ \hline \end{array}$$

⇒ - p = - 3

⇒ p = 3

Substitute p = 3 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

3 + q = 5

⇒ q = 5 – 3

⇒ q = 2

Thus, p = 3 and q = 2

As q = 1/x,

⇒ 2 = 1/x

⇒ x = 1/2

And p = 1/y

⇒ 3 = 1/y

⇒ y = 1/3

Hence, we have x = 1/2 and y = 1/3

Question: 27

Solve for x and y

Solution:

We have

$$\frac{5}{x+y} - \frac{2}{x-y} = -1$$

and $\frac{15}{x+y} + \frac{7}{x-y} = 10$

Lets simplify these equations. Assuming p = 1/(x + y) and q = 1/(x – y),

$$\frac{5}{x+y} - \frac{2}{x-y} = -1$$

5p – 2q = - 1 ...(i)

Also, $\frac{15}{x+y} + \frac{7}{x-y} = 10$

⇒ 15p + 7q = 10 ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 3, so that variable p in both the equations have same coefficient.

Recalling equations (i) & (ii),

5p – 2q = - 1 [×3

15p + 7q = 10

$$\begin{array}{r} 15p - 6q = -3 \\ 15p + 7q = 10 \\ (-) \quad (-) \quad (-) \\ \hline 0 - 13q = -13 \\ \hline \end{array}$$

⇒ - 13q = - 13

⇒ q = 1

Substitute q = 1 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

5p – 2(1) = - 1

⇒ 5p – 2 = - 1

⇒ 5p = 2 – 1 = 1

⇒ p = 1/5

Thus, p = 1/5 and q = 1

As p = 1/(x + y),

⇒ $\frac{1}{5} = \frac{1}{x+y}$

⇒ x + y = 5 ...(iii)

And q = 1/(x – y)

$\Rightarrow 1 = \frac{1}{x-y}$

⇒ x – y = 1 ...(iv)

Adding equations (iii) and (iv) to obtain x and y,

(x + y) + (x – y) = 5 + 1

⇒ 2x = 6

⇒ x = 3

Putting the value of x in equation (iii), we get

3 + y = 5

⇒ y = 2

Hence, we have x = 3 and y = 2

Question: 28

Solve for x and y

Solution:

We have

$$\frac{3}{x+y} + \frac{2}{x-y} = 2$$

and $\frac{9}{x+y} - \frac{4}{x-y} = 1$

Lets simplify these equations. Assuming p = 1/(x + y) and q = 1/(x – y),

$$\frac{3}{x+y} + \frac{2}{x-y} = 2$$

3p + 2q = 2 ...(i)

Also, $\frac{9}{x+y} - \frac{4}{x-y} = 1$

⇒ 9p – 4q = 1 ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 3, so that variable p in both the equations have same coefficient.

Recalling equations (i) & (ii),

3p + 2q = 2 [×3

9p – 4q = 1

$$\begin{array}{r} 9p + 6q = 6 \\ 9p - 4q = 1 \\ (-) \quad (+) \quad (-) \\ \hline 0 + 10q = 5 \\ \hline \end{array}$$

⇒ 10q = 5

⇒ q = 1/2

Substitute q = 1/2 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

3p + 2(1/2) = 2

⇒ 3p + 1 = 2

⇒ 3p = 2 – 1 = 1

⇒ p = 1/3

Thus, p = 1/3 and q = 1/2

As p = 1/(x + y),

$\Rightarrow \frac{1}{3} = \frac{1}{x+y}$

⇒ x + y = 3 ...(iii)

And q = 1/(x – y)

$\Rightarrow \frac{1}{2} = \frac{1}{x-y}$

⇒ x – y = 2 ...(iv)

Adding equations (iii) and (iv) to obtain x and y,

(x + y) + (x – y) = 3 + 2

⇒ 2x = 5

⇒ x = 5/2

Putting the value of x in equation (iii), we get

5/2 + y = 3

⇒ y = 3 – 5/2

⇒ y = 1/2

Hence, we have x = 5/2 and y = 1/2

Question: 29

Solve for x and y

Solution:

We have

$$\frac{5}{x+1} - \frac{2}{y-1} = \frac{1}{2}$$

and $\frac{10}{x+1} + \frac{2}{y-1} = \frac{5}{2}$

where x≠ - 1 and y≠1

Lets simplify these equations. Assuming p = 1/(x + 1) and q = 1/(y – 1),

$$\frac{5}{x+1} - \frac{2}{y-1} = \frac{1}{2}$$

5p – 2q = 1/2

10p – 4q = 1 ...(i)

Also, $\frac{10}{x+1} + \frac{2}{y-1} = \frac{5}{2}$

⇒ 10p + 2q = 5/2

⇒ 20p + 4q = 5 ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

The variable q in both the equations have same coefficient.

$$\begin{array}{r} 10p - 4q = 1 \\ 20p + 4q = 5 \\ \hline 30p + 0 = 6 \\ \hline \end{array}$$

⇒ 30p = 6

⇒ p = 1/5

Substitute p = 1/5 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

10(1/5) – 4q = 1

⇒ 2 – 4q = 1

⇒ 4q = 2 – 1 = 1

⇒ q = 1/4

Thus, p = 1/5 and q = 1/4

As p = 1/(x + 1),

⇒ $\frac{1}{5} = \frac{1}{x+1}$

⇒ x + 1 = 5

⇒ x = 4

And q = 1/(y – 1)

⇒ $\frac{1}{4} = \frac{1}{y-1}$

⇒ y – 1 = 4

⇒ y = 5

Hence, we have x = 4 and y = 5

Question: 30

Solve for x and y

Solution:

We have

$$\frac{44}{x+y} + \frac{30}{x-y} = 10$$

and $\frac{55}{x+y} + \frac{40}{x-y} = 13$

Lets simplify these equations. Assuming p = 1/(x + y) and q = 1/(x – y),

$$\frac{44}{x+y} + \frac{30}{x-y} = 10$$

44p + 30q = 10 …(i)

Also, $\frac{55}{x+y} + \frac{40}{x-y} = 13$

⇒ 55p + 40q = 13 …(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 4 and eq.(ii) by 3, so that variable q in both the equations have same coefficient.

Recalling equations (i) & (ii),

44p + 30q = 10 [×4

55p + 40q = 13 [×3

$$\begin{array}{r} 176p + 120q = 40 \\ 165p + 120q = 39 \\ (-) \quad (-) \quad (-) \\ \hline 11p + 0 = 1 \\ \hline \end{array}$$

⇒ 11p = 1

⇒ p = 1/11

Substitute p = 1/11 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

44(1/11) + 30q = 10

⇒ 4 + 30q = 10

⇒ 30q = 10 – 4 = 6

⇒ q = 1/5

Thus, p = 1/11 and q = 1/5

As p = 1/(x + y),

⇒ $\frac{1}{11} = \frac{1}{x+y}$

⇒ x + y = 11 ...(iii)

And q = 1/(x – y)

⇒ $\frac{1}{5} = \frac{1}{x-y}$

⇒ x – y = 5 ...(iv)

Adding equations (iii) and (iv) to obtain x and y,

(x + y) + (x – y) = 11 + 5

⇒ 2x = 16

⇒ x = 8

Putting the value of x in equation (iii), we get

8 + y = 11

⇒ y = 11 – 8

⇒ y = 3

Hence, we have x = 8 and y = 3

Question: 31

Solve for x and y

Solution:

We have

$$\frac{10}{x + y} + \frac{2}{x - y} = 4$$

and $\frac{15}{x+y} - \frac{9}{x-y} = -2$

Lets simplify these equations. Assuming p = 1/(x + y) and q = 1/(x – y),

$$\frac{10}{x+y} + \frac{2}{x-y} = 4$$

10p + 2q = 4 …(i)

Also, $\frac{15}{x+y} - \frac{9}{x-y} = -2$

⇒ 15p – 9q = - 2 …(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply eq.(i) by 9 and eq.(ii) by 2, so that variable q in both the equations have same coefficient.

Recalling equations (i) & (ii),

10p + 2q = 4 [×9]

15p – 9q = - 2 [×2]

$$\begin{array}{r} 90p + 18q = 36 \\ 30p - 18q = -4 \\ \hline 120p + 0 = 32 \\ \hline \end{array}$$

⇒ 120p = 32

⇒ p = 4/15

Substitute p = 4/15 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(ii), we get

15(4/15) – 9q = - 2

⇒ 4 – 9q = - 2

⇒ 9q = 4 + 2 = 6

⇒ q = 2/3

Thus, p = 4/15 and q = 2/3

As p = 1/(x + y),

⇒ $\frac{4}{15} = \frac{1}{x+y}$

⇒ 4x + 4y = 15 …(iii)

And q = 1/(x – y)

⇒ $\frac{2}{3} = \frac{1}{x-y}$

⇒ 2x – 2y = 3 …(iv)

Multiplying eq.(iv) by 2, we get

4x – 4y = 6 …(v)

and then adding equations (iii) and (v) to obtain x and y,

(4x + 4y) + (4x – 4y) = 6 + 15

⇒ 8x = 21

⇒ x = 21/8

Putting the value of x in equation (iv), we get

2(21/8) – 2y = 3

⇒ 21/4 – 2y = 3

⇒ 2y = 21/4 – 3 = 9/4

⇒ y = 9/8

Hence, we have x = 21/8 and y = 9/8

Question: 32

Solve for x and y

Solution:

We have,

71x + 37y = 253 …(i)

37x + 71y = 287 …(ii)

To solve these equations, we need to simplify them.

So, by adding equations (i) and (ii), we get

(71x + 37y) + (37x + 71y) = 253 + 287

⇒ (71x + 37x) + (37y + 71y) = 540

⇒ 108x + 108y = 540

Now dividing it by 108, we get

x + y = 5 …(iii)

Similarly, subtracting equations (i) and(ii),

(71x + 37y) – (37x + 71y) = 253 – 287

⇒ (71x – 37x) + (37y – 71y) = - 34

⇒ 34x – 34y = - 34

Dividing the equation by 34, we get

x – y = - 1 …(iv)

To solve equations (iii) and (iv), we need to make one of the variables (in both the equations) have same coefficient.

Here the variables x & y in both the equations have same coefficients.

$$\begin{array}{r} x + y = 5 \\ x - y = -1 \\ \hline 2x + 0 = 4 \\ \hline \end{array}$$

⇒ 2x = 4

⇒ x = 2

Substitute x = 2 in eq.(iii)/eq.(iv), as per convenience of solving.

Thus, substituting in eq.(iii), we get

2 + y = 5

⇒ y = 3

Hence, we have x = 2 and y = 3.

Question: 33

Solve for x and y

Solution:

We have,

217x + 131y = 913 …(i)

131x + 217y = 827 …(ii)

To solve these equations, we need to simplify them.

So, by adding equations (i) and (ii), we get

(217x + 131y) + (131x + 217y) = 913 + 827

⇒ (217x + 131x) + (131y + 217y) = 1740

⇒ 348x + 348y = 1740

Now dividing it by 348, we get

x + y = 5 …(iii)

Similarly, subtracting equations (i) and (ii),

(217x + 131y) – (131x + 217y) = 913 – 827

⇒ (217x – 131x) + (131y – 217y) = 86

⇒ 86x – 86y = 86

Dividing the equation by 86, we get

x – y = 1 …(iv)

To solve equations (iii) and (iv), we need to make one of the variables (in both the equations) have same coefficient.

Here the variables x & y in both the equations have same coefficients.

$$\begin{array}{l} \Rightarrow x + y = 5 \\ \quad\ x - y = 1 \\ \hline \quad 2x + 0 = 6 \\ \hline \end{array}$$

⇒ 2x = 6

⇒ x = 3

Substitute x = 3 in eq.(iii)/eq.(iv), as per convenience of solving.

Thus, substituting in eq.(iii), we get

3 + y = 5

⇒ y = 2

Hence, we have x = 3 and y = 2.

Question: 34

Solve for x and y

Solution:

We have,

23x – 29y = 98 …(i)

29x – 23y = 110 …(ii)

To solve these equations, we need to simplify them.

So, by adding equations (i) and (ii), we get

(23x – 29y) + (29x – 23y) = 98 + 110

⇒ (23x + 29x) – (29y + 23y) = 208

⇒ 52x – 52y = 208

Now dividing it by 52, we get

x – y = 4 ...(iii)

Similarly, subtracting equations (i) and(ii),

(23x – 29y) – (29x – 23y) = 98 – 110

⇒ (23x – 29x) – (29y – 23y) = - 12

⇒ - 6x – 6y = - 12

Dividing the equation by - 6, we get

x + y = 2 ...(iv)

To solve equations (iii) and (iv), we need to make one of the variables (in both the equations) have same coefficient.

Here the variables x & y in both the equations have same coefficients.

$$\begin{array}{c} x - y = 4 \\ x + y = 2 \\ \hline 2x + 0 = 6 \\ \hline \end{array}$$

⇒ 2x + 0 = 6

⇒ 2x = 6

⇒ x = 3

Substitute x = 3 in eq.(iii)/eq.(iv), as per convenience of solving.

Thus, substituting in eq.(iv), we get

3 + y = 2

⇒ y = - 1

Hence, we have x = 3 and y = - 1.

Question: 35

Solve for x and y

Solution:

We have

$$\frac{2x + 5y}{xy} = 6$$

and $\frac{4x-5y}{xy} = -3$

Lets simplify these equations. Assuming p = 1/x and q = 1/y,

$$\frac{2x + 5y}{xy} = 6$$

$\Rightarrow \frac{2}{y} + \frac{5}{x} = 6$

2q + 5p = 6 ...(i)

Also, $\frac{4x-5y}{xy} = -3$

$\Rightarrow \frac{4}{y} - \frac{5}{x} = -3$

⇒ 4q – 5p = - 3 ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Coefficients of p in both equations are already same.

$$\begin{array}{r} 2q + 5p = 6 \\ 4q - 5p = -3 \\ \hline 6q + 0 = 3 \\ \hline \end{array}$$

⇒ 6q = 3

⇒ q = 1/2

Substitute q = 1/2 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(ii), we get

4(1/2) – 5p = - 3

⇒ 2 – 5p = - 3

⇒ 5p = 5

⇒ p = 1

Thus, p = 1 and q = 1/2

As p = 1/x,

⇒ 1 = 1/x

⇒ x = 1

And q = 1/y,

⇒ $\frac{1}{2} = \frac{1}{y}$

⇒ y = 2

Hence, we have x = 1 and y = 2

Question: 36

Solve for x and y

Solution:

We have

$$\frac{1}{3x + y} + \frac{1}{3x - y} = \frac{3}{4}$$

and $\frac{1}{2(3x+y)} - \frac{1}{2(3x-y)} = \frac{-1}{8}$

Lets simplify these equations. Assuming p = 1/(3x + y) and q = 1/(3x – y),

$$\frac{1}{3x + y} + \frac{1}{3x - y} = \frac{3}{4}$$

p + q = 3/4

⇒ 4p + 4q = 3 ...(i)

Also, $\frac{1}{2(3x+y)} - \frac{1}{2(3x-y)} = \frac{-1}{8}$

⇒ p/2 – q/2 = - 1/8

⇒ 4p – 4q = - 1 ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

The variable p and q in both the equations have same coefficient.

$$\begin{array}{r} 4p + 4q = 3 \\ 4p - 4q = -1 \\ \hline 8p + 0 = 2 \\ \hline \end{array}$$

⇒ 8p = 2

⇒ p = 1/4

Substitute p = 1/4 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(ii), we get

4(1/4) – 4q = - 1

⇒ 1 – 4q = - 1

⇒ 4q = 2

⇒ q = 1/2

Thus, p = 1/4 and q = 1/2

As p = 1/(3x + y),

$\Rightarrow \frac{1}{4} = \frac{1}{3x+y}$

⇒ 3x + y = 4 …(iii)

And q = 1/(3x – y)

$\Rightarrow \frac{1}{2} = \frac{1}{3x-y}$

⇒ 3x – y = 2 …(iv)

Adding equations (iii) and (iv) to obtain x and y,

(3x + y) + (3x – y) = 4 + 2

⇒ 6x = 6

⇒ x = 1

Putting the value of x in equation (iv), we get

3(1) – y = 2

⇒ 3 – y = 2

⇒ y = 1

Hence, we have x = 1 and y = 1

Question: 37

Solve for x and y

Solution:

We have

$$\frac{1}{2(x+2y)} + \frac{5}{3(3x-2y)} = -\frac{3}{2}$$

and $\frac{5}{4(x+2y)} - \frac{3}{5(3x-2y)} = \frac{61}{60}$

Where x + 2y ≠ 0 and 3x - 2y ≠ 0

Lets simplify these equations. Assuming $p = \frac{1}{x+2y}$ and $q = \frac{1}{3x-2y}$

$\Rightarrow \frac{p}{2} + \frac{5q}{3} = -\frac{3}{2}$

Multiply it with 6, we get

3p + 10q = -9 …(i)

Also, $\frac{5}{4(x+2y)} - \frac{3}{5(3x-2y)} = \frac{61}{60}$

$\Rightarrow \frac{5p}{4} - \frac{3q}{5} = \frac{61}{60}$

Multiply it with 20, we get

25p – 12q = 61/3

⇒ 75 – 36q = 61 …(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Multiply equation (i) by 36 and equation (ii) by 10, so that the variables p and q in both the equations have same coefficients.

Recalling equations (i) and (ii),

3p + 10q = -9 [×36

75p – 36q = 61 [×10

$$\begin{array}{l} 108p + 360q = -324 \\ 750p - 360q = 610 \\ \hline 858p + \quad 0 \quad = 286 \\ \hline \end{array}$$

⇒ 858p = 286

⇒ p = 286/858 = 1/3

Substitute p = 1/3 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

3(1/3) + 10q = -9

⇒ 1 + 10q = -9

⇒ 10q = -9-1 = -10

⇒ q = -1

Thus, p=1/3 and q=-1

As p = 1/(x + 2y),

$\Rightarrow \frac{1}{3} = \frac{1}{x+2y}$

⇒ x + 2y = 3 …(iii)

And q = 1/(3x – 2y)

$\Rightarrow -1 = \frac{1}{3x-2y}$

⇒ 2y – 3x = 1 …(iv)

Subtracting equations (iii) and (iv) to obtain x and y,

(x + 2y) – (2y – 3x) = 3 – 1

⇒ x + 2y – 2y + 3x = 2

⇒ 4x = 2

⇒ x = 1/2

Putting the value of x in equation (iv), we get

2y – 3(1/2) = 1

⇒ 4y – 3 = 2

⇒ 4y = 2 + 3 = 5

⇒ y = 5/4

Hence, we have x=1/2 and y=5/4

Question: 38

Solve for x and y

Solution:

We have

$$\frac{2}{3x\ +\ 2y} + \frac{3}{3x - 2y} = \frac{17}{5}$$

and $\frac{5}{3x + 2y} + \frac{1}{3x - 2y} = 2$

Lets simplify these equations. Assuming p = 1/(3x + 2y) and q = 1/(3x – 2y),

$$\frac{2}{3x\ +\ 2y} + \frac{3}{3x - 2y} = \frac{17}{5}$$

2p + 3q = 17/5

⇒ 10p + 15q = 17 ...(i)

Also, $\frac{5}{3x + 2y} + \frac{1}{3x - 2y} = 2$

⇒ 5p + q = 2 ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Multiply equation (ii) by 2, so that the variable p in both the equations have same coefficient.

Recalling equations (i) and (ii),

10p + 15q = 17

5p + q = 2 [×2

$$\begin{array}{l} 10p + 15q = 17 \\ 10p + 2q = 4 \\ (-) \quad (-) \quad (-) \\ \hline 0 + 13q = 13 \\ \hline \end{array}$$

⇒ 13q = 13

⇒ q = 1

Substitute q = 1 in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(ii), we get

5p + 1 = 2

⇒ 5p = 1

⇒ p = 1/5

Thus, p = 1/5 and q = 1

As p = 1/(3x + 2y),

$\Rightarrow \frac{1}{5} = \frac{1}{3x + 2y}$

$\Rightarrow$ 3x + 2y = 5 …(iii)

And q = 1/(3x – 2y)

$\Rightarrow 1 = \frac{1}{3x-2y}$

$\Rightarrow$ 3x – 2y = 1 …(iv)

Adding equations (iii) and (iv) to obtain x and y,

(3x + 2y) + (3x – 2y) = 5 + 1

$\Rightarrow$ 6x = 6

$\Rightarrow$ x = 1

Putting the value of x in equation (iv), we get

3(1) – 2y = 1

$\Rightarrow$ 3 – 2y = 1

$\Rightarrow$ 2y = 2

$\Rightarrow$ y = 1

Hence, we have x = 1 and y = 1

Question: 39

Solve for x and y

Solution:

We have

3(2x + y) = 7xy

And 3(x + 3y) = 11xy

Lets simplify these equations.

3(2x + y) = 7xy

Dividing throughout by xy, and assuming p = 1/x and q = 1/y,

$\Rightarrow \frac{6x + 3y}{xy} = 7$

$\Rightarrow \frac{6}{y} + \frac{3}{x} = 7$

6q + 3p = 7 …(i)

Also, 3(x + 3y) = 11xy

Dividing throughout by xy, and assuming p = 1/x and q = 1/y,

$\Rightarrow \frac{3x + 9y}{xy} = 11$

$\Rightarrow \frac{3}{y} + \frac{9}{x} = 11$

$\Rightarrow$ 3q + 9p = 11 …(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Multiply equation (ii) by 2, so that the variable q in both the equations have same coefficient.

Recalling equations (i) and (ii),

6q + 3p = 7

$3q + 9p = 11$ [×2

$$\begin{array}{l} 3p + 6q = 7 \\ 18p + 6q = 22 \\ \underline{\;(-)\quad\;(-)\quad\;(-)\;} \\ \underline{-15p + 0 = -15} \end{array}$$

⇒ $-15p = -15$

⇒ $p = 1$

Substitute $p = 1$ in eq.(i)/eq.(ii), as per convenience of solving.

Thus, substituting in eq.(i), we get

$6q + 3(1) = 7$

⇒ $6q = 7 - 3$

⇒ $6q = 4$

⇒ $q = 2/3$

Thus, $p = 1$ and $q = 2/3$

As $p = 1$

⇒ $1 = 1/x$

⇒ $x = 1$

And $q = 1/y$,

⇒ $\frac{2}{3} = \frac{1}{y}$

⇒ $y = 3/2$

Hence, we have $x = 1$ and $y = 3/2$

Question: 40

Solve for x and y

Solution:

We have,

$x + y = a + b$ …(i)

$ax - by = a^2 - b^2$…(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply equation (i) by b, so that variable y in both the equations have same coefficient.

Recalling equations 1 & 2,

$x + y = a + b$ [×b

$ax - by = a^2 - b^2$

$$\begin{array}{l} bx + by = ab + b^2 \\ \underline{ax - by = a^2 - b^2} \\ \underline{bx + ax + 0 = ab + a^2} \end{array}$$

⇒ $bx + ax = ab + a^2$

⇒ $(b + a)x = a(a + b)$

⇒ $x = a$

Substitute x = a in equations (i)/(ii), as per convenience of solving.

Thus, substituting in equation (i), we get

$a + y = a + b$

$\Rightarrow y = b$

Hence, we have x = a and y = b.

Question: 41

Solve for x and y

Solution:

We have,

$\frac{x}{a} + \frac{y}{b} = 2$

$\Rightarrow bx + ay = 2ab$ ...(i)

$ax - by = a^2 - b^2$...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply equation (i) by b and (ii) by a, so that variable y in both the equations have same coefficient.

Recalling equations 1 & 2,

$bx + ay = 2ab$ [×b

$ax - by = a^2 - b^2$ [×a

$$\begin{array}{r} b^2x + aby = 2ab^2 \\ a^2x - aby = a^3 - ab^2 \\ \hline b^2x + a^2x + 0 = 2ab^2 + a^3 - ab^2 \\ \hline \end{array}$$

$\Rightarrow b^2x + a^2x = 2ab^2 + a^3 - ab^2$

$\Rightarrow (b^2 + a^2)x = a(2b^2 + a^2 - b^2)$

$\Rightarrow (b^2 + a^2)x = a(b^2 + a^2)$

$\Rightarrow x = a$

Substitute x = a in equations (i)/(ii), as per convenience of solving.

Thus, substituting in equation (i), we get

$ab + ay = 2ab$

$\Rightarrow ay = 2ab - ab = ab$

$\Rightarrow y = b$

Hence, we have x = a and y = b.

Question: 42

Solve for x and y

Solution:

We have,

$px + qy = p - q$ ...(i)

$qx - py = p + q$ ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply equation (i) by p and (ii) by q, so that variable y in both the equations have same coefficient.

Recalling equations (i) & (ii),

$px + qy = p - q$ [×p]

$qx - py = p + q$ [×q]

$$\begin{array}{r} p^2x + pqy = p^2 - pq \\ q^2x - pqy = pq + q^2 \\ \hline p^2x + q^2x + 0 = p^2 + q^2 \\ \hline \end{array}$$

$\Rightarrow p^2x + q^2x = p^2 + q^2$

$\Rightarrow (p^2 + q^2)x = p^2 + q^2$

$\Rightarrow x = 1$

Substitute $x = 1$ in equations (i)/(ii), as per convenience of solving.

Thus, substituting in equation (i), we get

$p + qy = p - q$

$\Rightarrow qy = - q$

$\Rightarrow y = - 1$

Hence, we have $x = 1$ and $y = - 1$.

Question: 43

Solve for x and y

Solution:

We have,

$$\frac{x}{a} - \frac{y}{b} = 0$$

$\Rightarrow bx - ay = 0$ ...(i)

$ax + by = a^2 + b^2$...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply equation (i) by b and (ii) by a, so that variable y in both the equations have same coefficient.

Recalling equations 1 & 2,

$bx - ay = 0$ [×b

$ax + by = a^2 + b^2$ [×a

$$\begin{array}{r} b^2x - aby = 0 \\ a^2x + aby = a^3 + ab^2 \\ \hline b^2x + a^2x + 0 = a^3 + ab^2 \\ \hline \end{array}$$

$b^2x + a^2x = a^3 + ab^2$

$\Rightarrow (b^2 + a^2)x = a\ (a^2 + b^2)$

$\Rightarrow (b^2 + a^2)x = a(b^2 + a^2)$

$\Rightarrow x = a$

Substitute x = a in equations (i)/(ii), as per convenience of solving.

Thus, substituting in equation (i), we get

ab – ay = 0

⇒ ay = ab

⇒ y = b

Hence, we have x = a and y = b.

Question: 44

Solve for x and y

Solution:

We have,

6(ax + by) = 3a + 2b

⇒ 6ax + 6by = 3a + 2b …(i)

6(bx – ay) = 3b – 2a

⇒ 6bx – 6ay = 3b – 2a …(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply equation (i) by a and (ii) by b, so that variable y in both the equations have same coefficient.

Recalling equations 1 & 2,

6ax + 6by = 3a + 2b [×a]

6bx – 6ay = 3b – 2a [×b]

$$\begin{array}{l} 6a^2x + 6aby = 3a^2 + 2ab \\ \underline{6b^2x - 6aby = 3b^2 - 2ab} \\ \underline{6a^2x + 6b^2x + 0 = 3a^2} + 3b^2 \end{array}$$

⇒ $6a^2x + 6b^2x + 0 = 3a^2 + 3b^2$

⇒ $6(a^2 + b^2)x = 3(a^2 + b^2)$

⇒ 2x = 1

⇒ x = 1/2

Substitute x = 1/2 in equations (i)/(ii), as per convenience of solving.

Thus, substituting in equation (i), we get

6a(1/2) + 6by = 3a + 2b

⇒ 3a + 6by = 3a + 2b

⇒ 6by = 2b

⇒ y = 1/3

Hence, we have x = 1/2 and y = 1/3.

Question: 45

Solve for x and y

Solution:

We have,

ax – by = $a^2 + b^2$ …(i)

$x + y = 2a$ ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply equation (ii) by b, so that variable y in both the equations have same coefficient.

Recalling equations (i) & (ii),

$ax - by = a^2 + b^2$

$x + y = 2a$ [×b

$$\begin{array}{l} \Rightarrow\ ax - by = a^2 + b^2 \\ \quad\ \ bx + by = 2ab \\ \hline ax + bx + 0 = a^2 + b^2 + 2ab \\ \hline \end{array}$$

$\Rightarrow ax + bx = a^2 + b^2 + 2ab$

$\Rightarrow (a + b)x = (a + b)^2$

$\Rightarrow x = a + b$

Substitute $x = (a + b)$ in equations (i)/(ii), as per convenience of solving.

Thus, substituting in equation (ii), we get

$a + b + y = 2a$

$\Rightarrow y = 2a - a - b$

$\Rightarrow y = a - b$

Hence, we have $x = (a + b)$ and $y = (a - b)$.

Question: 46

Solve for x and y

Solution:

We have,

$$\frac{bx}{a} - \frac{ay}{b} + a + b = 0$$

$\Rightarrow b^2x - a^2y + a^2b + ab^2 = 0$

$\Rightarrow a^2y - b^2x = a^2b + ab^2$ ...(i)

$bx - ay = -2ab$

$\Rightarrow ay - bx = 2ab$ ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply equation (ii) by b, so that variable y in both the equations have same coefficient.

Recalling equations (i) & (ii),

$a^2y - b^2x = a^2b + ab^2$

$ay - bx = 2ab$ [×b]

$$\begin{array}{l} a^2y - b^2x = a^2b + ab^2 \\ \underset{(-)}{aby} \ \underset{(+)}{-\ b^2x} = \underset{(-)}{2ab^2} \\ \hline a^2y - aby + 0 = a^2b - ab^2 \\ \hline \end{array}$$

$\Rightarrow a^2y - aby = a^2b - ab^2$

$\Rightarrow (a^2 - ab)y = a^2b - ab^2$

$\Rightarrow a(a - b)y = ab(a - b)$

$\Rightarrow y = b$

Substitute y = b in equations (i)/(ii), as per convenience of solving.

Thus, substituting in equation (ii), we get

$a(b) - bx = 2ab$

$\Rightarrow ab - bx = 2ab$

$\Rightarrow bx = ab - 2ab = - ab$

$\Rightarrow x = - a$

Hence, we have x = - a and y = b.

Question: 47

Solve for x and y

Solution:

We have,

$\frac{bx}{a} + \frac{ay}{b} = a^2 + b^2$

$\Rightarrow b^2x + a^2y = a^3b + ab^3$ ...(i)

$x + y = 2ab$ ...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply equation (ii) by a^2, so that variable y in both the equations have same coefficient.

Recalling equations (i) & (ii),

$b^2x + a^2y = a^3b + ab^3$

$x + y = 2ab$ [$\times a^2$]

$$\begin{array}{r} b^2x + a^2y = a^3b + ab^3 \\ a^2x + a^2y = 2a^3b \\ (-) \quad\ (-) \qquad (-) \\ \hline b^2x - a^2x + 0 = -a^3b + ab^3 \\ \hline \end{array}$$

$\Rightarrow b^2x - a^2x = - a^3b + ab^3$

$\Rightarrow (b^2 - a^2)x = ab(b^2 - a^2)$

$\Rightarrow x = ab$

Substitute x = ab in equations (i)/(ii), as per convenience of solving.

Thus, substituting in equation (ii), we get

$(ab) + y = 2ab$

$\Rightarrow y = ab$

Hence, we have x = ab and y = ab.

Question: 48

Solve for x and y

Solution:

We have,

$x + y = a + b$ ...(i)

$ax - by = a^2 - b^2$...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply equation (i) by b, so that variable y in both the equations have same coefficient.

Recalling equations (i) & (ii),

$x + y = a + b$ [×b

$ax - by = a^2 - b^2$

$$\begin{array}{l} bx + by = ab + b^2 \\ ax - by = a^2 - b^2 \\ \hline bx + ax + 0 = ab + a^2 \\ \hline \end{array}$$

$\Rightarrow bx + ax = ab + a^2$

$\Rightarrow (b + a)x = a(b + a)$

$\Rightarrow x = a$

Substitute $x = a$ in equations (i)/(ii), as per convenience of solving.

Thus, substituting in equation (i), we get

$a + y = a + b$

$\Rightarrow y = b$

Hence, we have $x = a$ and $y = b$.

Question: 49

Solve for x and y

Solution:

We have,

$a^2x + b^2y = c^2$ ...(i)

$b^2x + a^2y = d^2$...(ii)

To solve these equations, we need to simplify them.

So, by adding equations (i) and (ii), we get

$(a^2x + b^2y) + (b^2x + a^2y) = c^2 + d^2$

$\Rightarrow (a^2x + b^2x) + (b^2y + a^2y) = c^2 + d^2$

$\Rightarrow (a^2 + b^2)x + (a^2 + b^2)y = c^2 + d^2$

Now dividing it by $(a^2 + b^2)$, we get

$x + y = (c^2 + d^2)/(a^2 + b^2)$ ...(iii)

Similarly, subtracting equations (i) and (ii),

$(a^2x + b^2y) - (b^2x + a^2y) = c^2 - d^2$

$\Rightarrow (a^2x - b^2x) - (b^2y - a^2y) = c^2 - d^2$

$\Rightarrow (a^2 - b^2)x - (a^2 - b^2)y = c^2 - d^2$

Dividing the equation by $(a^2 - b^2)$, we get

$x - y = (c^2 - d^2)/ (a^2 - b^2)$ ...(iv)

To solve equations (iii) and (iv), we need to make one of the variables (in both the equations) have same coefficient.

Here the variables x in both the equations have same coefficients.

$$\begin{array}{l} x + y = (c^2 + d^2)/ (a^2 + b^2) \\ x - y = (c^2 - d^2)/ (a^2 - b^2) \\ \hline 2x + 0 = \frac{c^2+d^2}{a^2+b^2} + \frac{c^2-d^2}{a^2-b^2} \\ \hline \end{array}$$

$$\Rightarrow 2x = \frac{c^2 + d^2}{a^2 + b^2} + \frac{c^2 - d^2}{a^2 - b^2}$$

$$\Rightarrow 2x = \frac{(c^2 + d^2)(a^2 - b^2) + (c^2 - d^2)(a^2 + b^2)}{a^4 - b^4}$$

$$\Rightarrow 2x = \frac{c^2a^2 - c^2b^2 + d^2a^2 - d^2b^2 + c^2a^2 + c^2b^2 - d^2a^2 - d^2b^2}{a^4 - b^4}$$

$$\Rightarrow 2x = \frac{2c^2a^2 - 2d^2b^2}{a^4 - b^4}$$

$$\Rightarrow x = \frac{c^2a^2 - d^2b^2}{a^4 - b^4}$$

Substitute $x = \frac{c^2a^2 - d^2b^2}{a^4 - b^4}$ in eq.(iii)/eq.(iv), as per convenience of solving.

Thus, substituting in eq.(iii), we get

$$\frac{c^2a^2 - d^2b^2}{a^4 - b^4} + y = \frac{c^2 + d^2}{a^2 + b^2}$$

$$\Rightarrow y = \frac{c^2 + d^2}{a^2 + b^2} - \frac{c^2a^2 - d^2b^2}{a^4 - b^4}$$

$$\Rightarrow y = \frac{(c^2 + d^2)(a^2 - b^2) - (c^2a^2 - d^2b^2)}{a^4 - b^4}$$

$$\Rightarrow y = \frac{c^2a^2 - c^2b^2 + d^2a^2 - d^2b^2 - c^2a^2 + d^2b^2}{a^4 - b^4}$$

$$\Rightarrow y = \frac{d^2a^2 - c^2b^2}{a^4 - b^4}$$

Hence, we have $x = \frac{c^2a^2 - d^2b^2}{a^4 - b^4}$ and $y = \frac{d^2a^2 - c^2b^2}{a^4 - b^4}$.

Question: 50

Solve for x and y

Solution:

We have,

$$\frac{x}{a} + \frac{y}{b} = a + b$$

$\Rightarrow bx + ay = a^2b + ab^2$ ...(i)

$$\frac{x}{a^2} + \frac{y}{b^2} = 2$$

$b^2x + a^2y = 2a^2b^2$...(ii)

To solve these equations, we need to make one of the variables (in both the equations) have same coefficient.

Lets multiply equation (i) by a, so that variable y in both the equations have same coefficient.

Recalling equations (i) & (ii),

$bx + ay = a^2b + ab^2$ [×a

$b^2x + a^2y = 2a^2b^2$

$$\begin{array}{l} \Rightarrow abx + a^2y = a^3b + a^2b^2 \\ \quad b^2x + a^2y = 2a^2b^2 \\ \quad (-) \qquad (-) \qquad (-) \\ \hline abx - b^2x + 0 = a^3b - a^2b^2 \\ \hline \end{array}$$

$\Rightarrow abx - b^2x = a^3b - a^2b^2$

$\Rightarrow b(a - b)x = a^2b(a - b)$

$\Rightarrow x = a^2$

Substitute $x = a^2$ in equations (i)/(ii), as per convenience of solving.

Thus, substituting in equation (i), we get

$b(a^2) + ay = a^2b + ab^2$

$\Rightarrow a^2b + ay = a^2b + ab^2$

$\Rightarrow ay = ab^2$

$\Rightarrow y = b^2$

Hence, we have $x = a^2$ and $y = b^2$.

Exercise : 3C

Question: 1

Solve each of the

Solution:

We have,

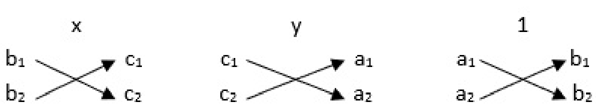
$x + 2y + 1 = 0$ ...(i)

$2x - 3y - 12 = 0$ ...(ii)

From equation (i), we get $a_1 = 1$, $b_1 = 2$ and $c_1 = 1$

And from equation (ii), we get $a_2 = 2$, $b_2 = - 3$ and $c_2 = - 12$

Using cross multiplication,



$$\frac{x}{[b_1c_2 - b_2c_1]} = \frac{y}{[c_1a_2 - c_2a_1]} = \frac{1}{[a_1b_2 - a_2b_1]}$$

$$\Rightarrow \frac{x}{[2\times(-12)-(-3)\times 1]} = \frac{y}{[1\times 2-(-12)\times 1]} = \frac{1}{[1\times(-3)-2\times 2]}$$

$$\Rightarrow \frac{x}{-24+3} = \frac{y}{2+12} = \frac{1}{-3-4}$$

$$\Rightarrow \frac{x}{-21} = \frac{y}{14} = \frac{1}{-7}$$

$\Rightarrow \frac{x}{-21} = \frac{1}{-7}$ and $\frac{y}{14} = \frac{1}{-7}$

$\Rightarrow x = \frac{21}{7}$ and $y = \frac{-14}{7}$

$\Rightarrow x = 3$ and $y = -2$

Thus, $x = 3$, $y = -2$

Question: 2

Solve each of the

Solution:

We have,

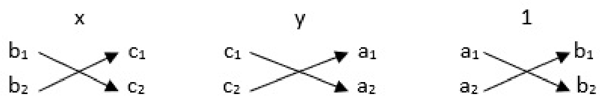
$3x - 2y + 3 = 0$ ...(i)

$4x + 3y - 47 = 0$ ...(ii)

From equation (i), we get $a_1 = 3$, $b_1 = -2$ and $c_1 = 3$

And from equation (ii), we get $a_2 = 4$, $b_2 = 3$ and $c_2 = -47$

Using cross multiplication,



$$\frac{x}{[b_1c_2 - b_2c_1]} = \frac{y}{[c_1a_2 - c_2a_1]} = \frac{1}{[a_1b_2 - a_2b_1]}$$

$\Rightarrow \frac{x}{[(-2)\times(-47)-3\times3]} = \frac{y}{[3\times4-(-47)\times3]} = \frac{1}{[3\times3-4\times(-2)]}$

$\Rightarrow \frac{x}{94-9} = \frac{y}{12+141} = \frac{1}{9+8}$

$\Rightarrow \frac{x}{85} = \frac{y}{153} = \frac{1}{17}$

$\Rightarrow \frac{x}{85} = \frac{1}{17}$ and $\frac{y}{153} = \frac{1}{17}$

$\Rightarrow x = \frac{85}{17}$ and $y = \frac{153}{17}$

$\Rightarrow x = 5$ and $y = 9$

Thus, $x = 5$, $y = 9$

Question: 3

Solve each of the

Solution:

We have,

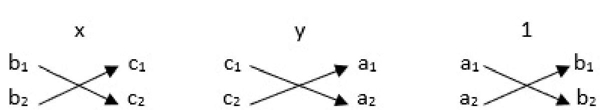
$6x - 5y - 16 = 0$ ...(i)

$7x - 13y + 10 = 0$ ...(ii)

From equation (i), we get $a_1 = 6$, $b_1 = -5$ and $c_1 = -16$

And from equation (ii), we get $a_2 = 7$, $b_2 = -13$ and $c_2 = 10$

Using cross multiplication,



$$\frac{x}{[b_1c_2 - b_2c_1]} = \frac{y}{[c_1a_2 - c_2a_1]} = \frac{1}{[a_1b_2 - a_2b_1]}$$

$\Rightarrow \frac{x}{[(-5)\times10-(-13)\times(-16)]} = \frac{y}{[(-16)\times7-10\times6]} = \frac{1}{[6\times(-13)-7\times(-5)]}$

$\Rightarrow \frac{x}{-50-208} = \frac{y}{-112-60} = \frac{1}{-78+35}$

$\Rightarrow \frac{x}{-258} = \frac{y}{-172} = \frac{1}{-43}$

$\Rightarrow \frac{x}{-258} = \frac{1}{-43}$ and $\frac{y}{-172} = \frac{1}{-43}$

$\Rightarrow x = \frac{-258}{-43}$ and $y = \frac{-172}{-43}$

$\Rightarrow$ x = 6 and y = 4

Thus, x = 6, y = 4

Question: 4

Solve each of the

Solution:

We have,

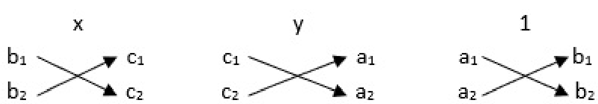
3x + 2y + 25 = 0 …(i)

2x + y + 10 = 0 …(ii)

From equation (i), we get $a_1 = 3$, $b_1 = 2$ and $c_1 = 25$

And from equation (ii), we get $a_2 = 2$, $b_2 = 1$ and $c_2 = 10$

Using cross multiplication,



$$\frac{x}{[b_1c_2 - b_2c_1]} = \frac{y}{[c_1a_2 - c_2a_1]} = \frac{1}{[a_1b_2 - a_2b_1]}$$

$\Rightarrow \frac{x}{[2\times10-1\times25]} = \frac{y}{[25\times2-10\times3]} = \frac{1}{[3\times1-2\times2]}$

$\Rightarrow \frac{x}{20-25} = \frac{y}{50-30} = \frac{1}{3-4}$

$\Rightarrow \frac{x}{-5} = \frac{y}{20} = \frac{1}{-1}$

$\Rightarrow \frac{x}{-5} = -1$ and $\frac{y}{20} = -1$

$\Rightarrow$ x = 5 and y = - 20

Thus, x = 5, y = - 20

Question: 5

Solve each of the

Solution:

We have,

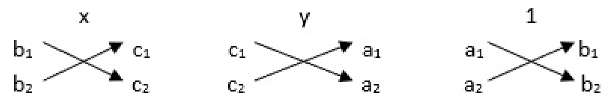
2x + 5y – 1 = 0 …(i)

2x + 3y – 3 = 0 …(ii)

From equation (i), we get $a_1 = 2$, $b_1 = 5$ and $c_1 = -1$

And from equation (ii), we get $a_2 = 2$, $b_2 = 3$ and $c_2 = -3$

Using cross multiplication,



$$\frac{x}{[b_1c_2 - b_2c_1]} = \frac{y}{[c_1a_2 - c_2a_1]} = \frac{1}{[a_1b_2 - a_2b_1]}$$

$$\Rightarrow \frac{x}{[5\times(-3)-3\times(-1)]} = \frac{y}{[(-1)\times2-(-3)\times2]} = \frac{1}{[2\times3-2\times5]}$$

$$\Rightarrow \frac{x}{-15+3} = \frac{y}{-2+6} = \frac{1}{6-10}$$

$$\Rightarrow \frac{x}{-12} = \frac{y}{4} = \frac{1}{-4}$$

$\Rightarrow \frac{x}{-12} = \frac{1}{-4}$ and $\frac{y}{4} = \frac{1}{-4}$

$\Rightarrow x = \frac{-12}{-4}$ and $y = \frac{4}{-4}$

$\Rightarrow x = 3$ and $y = -1$

Thus, $x = 3$, $y = -1$

Question: 6

Solve each of the

Solution:

We have,

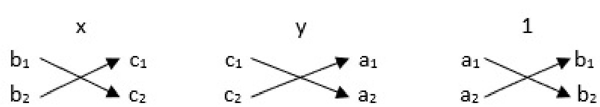
$2x + y - 35 = 0$ ...(i)

$3x + 4y - 65 = 0$ ...(ii)

From equation (i), we get $a_1 = 2$, $b_1 = 1$ and $c_1 = -35$

And from equation (ii), we get $a_2 = 3$, $b_2 = 4$ and $c_2 = -65$

Using cross multiplication,



$$\frac{x}{[b_1c_2 - b_2c_1]} = \frac{y}{[c_1a_2 - c_2a_1]} = \frac{1}{[a_1b_2 - a_2b_1]}$$

$$\Rightarrow \frac{x}{[1\times(-65)-4\times(-35)]} = \frac{y}{[(-35)\times3-(-65)\times2]} = \frac{1}{[2\times4-3\times1]}$$

$$\Rightarrow \frac{x}{-65+140} = \frac{y}{-105+130} = \frac{1}{8-3}$$

$$\Rightarrow \frac{x}{75} = \frac{y}{25} = \frac{1}{5}$$

$\Rightarrow \frac{x}{75} = \frac{1}{5}$ and $\frac{y}{25} = \frac{1}{5}$

$\Rightarrow x = \frac{75}{5}$ and $y = \frac{25}{5}$

$\Rightarrow x = 15$ and $y = 5$

Thus, $x = 15$, $y = 5$

Question: 7

Solve each of the

Solution:

We have,

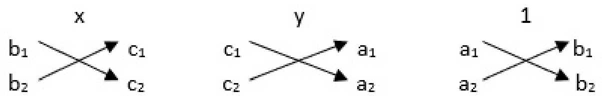
7x – 2y – 3 = 0 ...(i)

22x – 3y – 16 = 0 ...(ii)

From equation (i), we get a_1 = 7, b_1 = - 2 and c_1 = - 3

And from equation (ii), we get a_2 = 22, b_2 = - 3 and c_2 = - 16

Using cross multiplication,



$$\frac{x}{[b_1c_2 - b_2c_1]} = \frac{y}{[c_1a_2 - c_2a_1]} = \frac{1}{[a_1b_2 - a_2b_1]}$$

$$\Rightarrow \frac{x}{[(-2)\times(-16)-(-3)\times(-3)]} = \frac{y}{[(-3)\times 22-(-16)\times 7]} = \frac{1}{[7\times(-3)-22\times(-2)]}$$

$$\Rightarrow \frac{x}{32-9} = \frac{y}{-66+112} = \frac{1}{-21+44}$$

$$\Rightarrow \frac{x}{23} = \frac{y}{46} = \frac{1}{23}$$

$\Rightarrow \frac{x}{23} = \frac{1}{23}$ and $\frac{y}{46} = \frac{1}{23}$

$\Rightarrow x = \frac{23}{23}$ and $y = \frac{46}{23}$

⇒ x = 1 and y = 2

Thus, x = 1, y = 2

Question: 8

Solve each of the

Solution:

We have,

$\frac{x}{6} + \frac{y}{15} = 4$ ...(i)

$\frac{x}{3} - \frac{y}{12} = \frac{19}{4}$ ...(ii)

By simplifying, we get

From equation (i), $\frac{5x+2y}{30} = 4$

⇒ 5x + 2y – 120 = 0 ...(iii)

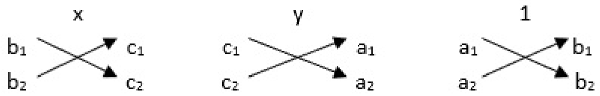
From equation (ii), $\frac{4x-y}{12} = \frac{19}{4}$

⇒ 4x – y – 57 = 0 ...(iv)

From equation (iii), we get a_1 = 5, b_1 = 2 and c_1 = - 120

And from equation (ii) we get a_2 = 4, b_2 = - 1 and c_2 = - 57

Using cross multiplication,



$$\frac{x}{[b_1c_2 - b_2c_1]} = \frac{y}{[c_1a_2 - c_2a_1]} = \frac{1}{[a_1b_2 - a_2b_1]}$$

$\Rightarrow \frac{x}{[2\times(-57)-(-1)\times(-120)]} = \frac{y}{[(-120)\times 4-(-57)\times 5]} = \frac{1}{[5\times(-1)-4\times 2]}$

$\Rightarrow \frac{x}{-114-120} = \frac{y}{-480+285} = \frac{1}{-5-8}$

$\Rightarrow \frac{x}{-234} = \frac{y}{-195} = \frac{1}{-13}$

$\Rightarrow \frac{x}{-234} = \frac{1}{-13}$ and $\frac{y}{-195} = \frac{1}{-13}$

$\Rightarrow x = \frac{-234}{-13}$ and $y = \frac{-195}{-13}$

$\Rightarrow$ x = 18 and y = 15

Thus, x = 18, y = 15

Question: 9

Solve each of the

Solution:

We have,

$\frac{1}{x} + \frac{1}{y} = 7$ ...(i)

$\frac{2}{x} + \frac{3}{y} = 17$ ...(ii)

Let 1/x = p and 1/y = q. Now,

From equation (i), p + q = 7

$\Rightarrow$ p + q – 7 = 0 ...(iii)

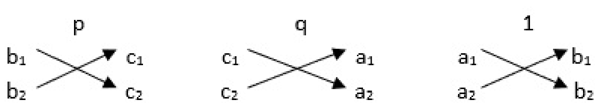
From equation (ii), 2p – 3q = 17

$\Rightarrow$ 2p + 3q – 17 = 0 ...(iv)

From equation (iii), we get $a_1 = 1$, $b_1 = 1$ and $c_1 = -7$

And from equation (iv), we get $a_2 = 2$, $b_2 = 3$ and $c_2 = -17$

Using cross multiplication,



$$\frac{p}{[b_1c_2 - b_2c_1]} = \frac{q}{[c_1a_2 - c_2a_1]} = \frac{1}{[a_1b_2 - a_2b_1]}$$

$\Rightarrow \frac{p}{[1\times(-17)-3\times(-7)]} = \frac{q}{[(-7)\times 2-(-17)\times 1]} = \frac{1}{[1\times 3-2\times 1]}$

$\Rightarrow \frac{p}{-17+21} = \frac{q}{-14+17} = \frac{1}{3-2}$

$\Rightarrow \frac{p}{4} = \frac{q}{3} = \frac{1}{1}$

$\Rightarrow \frac{p}{4} = 1$ and $\frac{q}{3} = 1$

⇒ p = 4 and q = 3

⇒ x = 1/4 and y = 1/3 [∵ p = 1/x and q = 1/y]

Thus, x = 1/4, y = 1/3

Question: 10

Solve each of the

Solution:

We have,

$\frac{5}{(x+y)} - \frac{2}{(x-y)} + 1 = 0$ ...(i)

$\frac{15}{(x+y)} + \frac{7}{(x-y)} - 10 = 0$ ...(ii)

Let 1/(x + y) = p and 1/(x - y) = q. Now,

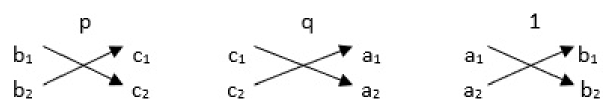
From equation (i), 5p – 2q + 1 = 0 ...(iii)

From equation (ii), 15p + 7q – 10 = 0 ...(iv)

From equation (iii), we get $a_1 = 5$, $b_1 = -2$ and $c_1 = 1$

And from equation (iv), we get $a_2 = 15$, $b_2 = 7$ and $c_2 = -10$

Using cross multiplication,



$$\frac{p}{[b_1c_2 - b_2c_1]} = \frac{q}{[c_1a_2 - c_2a_1]} = \frac{1}{[a_1b_2 - a_2b_1]}$$

$\Rightarrow \frac{p}{[(-2)\times(-10)-7\times1]} = \frac{q}{[1\times15-(-10)\times5]} = \frac{1}{[5\times7-15\times(-2)]}$

$\Rightarrow \frac{p}{20-7} = \frac{q}{15+50} = \frac{1}{35+30}$

$\Rightarrow \frac{p}{13} = \frac{q}{65} = \frac{1}{65}$

$\Rightarrow \frac{p}{13} = \frac{1}{65}$ and $\frac{q}{65} = \frac{1}{65}$

$\Rightarrow p = \frac{13}{65}$ and $q = \frac{65}{65}$

⇒ p = 1/5 and q = 1

$\Rightarrow \frac{1}{(x+y)} = \frac{1}{5}$ and $\frac{1}{(x-y)} = 1$ [∵ p = 1/(x + y) and q = 1/(x - y)]

To solve these, we need to take reciprocal of these equations. By taking reciprocal, we get

x + y = 5 and x – y = 1

Rearranging them again,

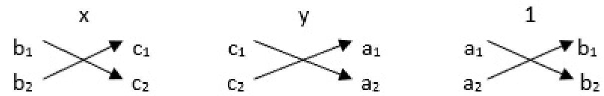
x + y – 5 = 0 ...(v)

x – y – 1 = 0 ...(vi)

From equation (v), we get $a_1 = 1$, $b_1 = 1$ and $c_1 = -5$

And from equation (vi), we get $a_2 = 1$, $b_2 = -1$ and $c_2 = -1$

Using cross multiplication,



$$\frac{x}{[b_1c_2 - b_2c_1]} = \frac{y}{[c_1a_2 - c_2a_1]} = \frac{1}{[a_1b_2 - a_2b_1]}$$

$\Rightarrow \frac{x}{[1\times(-1)-(-1)\times(-5)]} = \frac{y}{[(-5)\times1-(-1)\times1]} = \frac{1}{[1\times(-1)-1\times1]}$

$\Rightarrow \frac{x}{-1-5} = \frac{y}{-5+1} = \frac{1}{-1-1}$

$\Rightarrow \frac{x}{-6} = \frac{y}{-4} = \frac{1}{-2}$

$\Rightarrow \frac{x}{-6} = \frac{1}{-2}$ and $\frac{y}{-4} = \frac{1}{-2}$

$\Rightarrow x = \frac{-6}{-2}$ and $y = \frac{-4}{-2}$

$\Rightarrow x = 3$ and $y = 2$

Thus, $x = 3$, $y = 2$

Question: 11

Solve each of the

Solution:

We have,

$\frac{ax}{b} - \frac{by}{a} = a + b$ …(i)

$ax - by = 2ab$ …(ii)

By simplifying, we get

From equation (i),

$\frac{ax}{b} - \frac{by}{a} - (a + b) = 0$ …(iii)

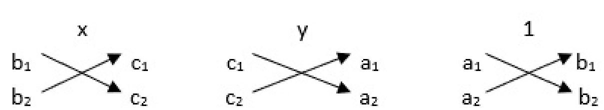
From equation (ii),

$ax - by - 2ab = 0$ …(iv)

From equation (iii), we get $a_1 = a/b$, $b_1 = -b/a$ and $c_1 = -(a + b)$

And from equation (iv), we get $a_2 = a$, $b_2 = -b$ and $c_2 = -2ab$

Using cross multiplication,



$$\frac{x}{[b_1c_2 - b_2c_1]} = \frac{y}{[c_1a_2 - c_2a_1]} = \frac{1}{[a_1b_2 - a_2b_1]}$$

$\Rightarrow \frac{x}{[\left(\frac{-b}{a}\right)\times(-2ab)-(-b)\times(-(a+b))]} = \frac{y}{[-(a+b)\times a-(-2ab)\times\left(\frac{a}{b}\right)]} = \frac{1}{[\left(\frac{a}{b}\right)\times(-b)-a\times\left(\frac{-b}{a}\right)]}$

$\Rightarrow \frac{x}{2b^2-ab-b^2} = \frac{y}{-a^2-ab+2a^2} = \frac{1}{-a+b}$

$\Rightarrow \frac{x}{b^2-ab} = \frac{y}{a^2-ab} = \frac{1}{b-a}$

$\Rightarrow \frac{x}{b(b-a)} = \frac{1}{b-a}$ and $\frac{y}{a(a-b)} = \frac{1}{b-a}$

$\Rightarrow x = \frac{b(b-a)}{(b-a)}$ and $y = \frac{a(a-b)}{b-a}$

$\Rightarrow$ x = b and y = - a

Thus, x = b, y = - a

Question: 12

Solve each of the

Solution:

We have,

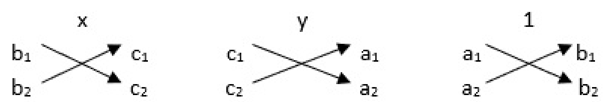
2ax + 3by – (a + 2b) = 0 ...(i)

3ax + 2by – (2a + b) = 0 ...(ii)

From equation (i), we get a_1 = 2a, b_1 = 3b and c_1 = - (a + 2b)

And from equation (ii), we get a_2 = 3a, b_2 = 2b and c_2 = - (2a + b)

Using cross multiplication,



$$\frac{x}{[b_1c_2 - b_2c_1]} = \frac{y}{[c_1a_2 - c_2a_1]} = \frac{1}{[a_1b_2 - a_2b_1]}$$

$$\Rightarrow \frac{x}{[3b\times(-2a-b)-2b\times(-a-2b)]} = \frac{y}{[-(a+2b)\times 3a-(-2a-b)\times 2a]} = \frac{1}{[2a\times 2b-3a\times 3b]}$$

$$\Rightarrow \frac{x}{-6ab-3b^2+2ab+4b^2} = \frac{y}{-3a^2-6ab+4a^2+2ab} = \frac{1}{4ab-9ab}$$

$$\Rightarrow \frac{x}{b^2-4ab} = \frac{y}{a^2-4ab} = \frac{1}{-5ab}$$

$\Rightarrow \frac{x}{b(b-4a)} = \frac{1}{-5ab}$ and $\frac{y}{a(a-4b)} = \frac{1}{-5ab}$

$\Rightarrow x = \frac{b(b-4a)}{-5ab}$ and $y = \frac{a(a-4b)}{-5ab}$

$\Rightarrow x = \frac{4a-b}{5a}$ and $y = \frac{4b-a}{5b}$

Thus, $x = \frac{4a-b}{5a}$, $y = \frac{4b-a}{5b}$

Question: 13

Solve each of the

Solution:

We have,

$\frac{a}{x} - \frac{b}{y} = 0$ ...(i)

$\frac{ab^2}{x} - \frac{a^2b}{y} = a^2 + b^2$ ...(ii)

Let 1/x = p and 1/y = q. Now,

From equation (i), ap – bq = 0

$\Rightarrow$ ap – bq + 0 = 0 ...(iii)

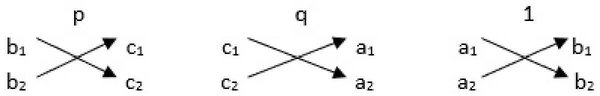
From equation (ii), $ab^2p - a^2bq = (a^2 + b^2)$

$\Rightarrow ab^2p - a^2bq - (a^2 + b^2) = 0$ ...(iv)

From equation (iii), we get $a_1 = a$, $b_1 = -b$ and $c_1 = 0$

And from equation (iv), we get $a_2 = ab^2$, $b_2 = -a^2b$ and $c_2 = -(a^2 + b^2)$

Using cross multiplication,



$$\frac{p}{[b_1c_2 - b_2c_1]} = \frac{q}{[c_1a_2 - c_2a_1]} = \frac{1}{[a_1b_2 - a_2b_1]}$$

$$\Rightarrow \frac{p}{[(-b)\times(-a^2-b^2)-(-b^2)\times 0]} = \frac{q}{[0\times ab^2-(-a^2-b^2)\times a]} = \frac{1}{[a\times(-a^2b)-ab^2\times(-b)]}$$

$$\Rightarrow \frac{p}{(a^2b + b^3)} = \frac{q}{(a^3 + ab^2)} = \frac{1}{-a^3b + ab^3}$$

$$\Rightarrow \frac{p}{b(a^2 + b^2)} = \frac{q}{a(a^2 + b^2)} = \frac{1}{ab(b^2 + a^2)}$$

$$\Rightarrow \frac{p}{b(a^2 + b^2)} = \frac{1}{ab(b^2 + a^2)} \text{ and } \frac{q}{a(a^2 + b^2)} = \frac{1}{ab(b^2 + a^2)}$$

$$\Rightarrow p = \frac{b(a^2 + b^2)}{ab(b^2 + a^2)} \text{ and } q = \frac{a(a^2 + b^2)}{ab(b^2 + a^2)}$$

$\Rightarrow p = 1/a$ and $q = 1/b$

Thus, $x = a$, $y = b$ [$\because p = 1/x$ and $q = 1/y$]

Exercise : 3D

Question: 1

Show that each of

Solution:

Given: $3x + 5y = 12$ – eq 1

$5x + 3y = 4$ – eq 2

Here,

$a_1 = 3$, $b_1 = 5$, $c_1 = -12$

$a_2 = 5$, $b_2 = 3$, $c_2 = -4$

$\frac{a1}{a2} = \frac{3}{5}, \frac{b1}{b2} = \frac{5}{3}$

Here, $\frac{a1}{a2} \neq \frac{b1}{b2}$

$\therefore$ given system of equations have unique solutions.

Now,

In – eq 1

$3x = 12 - 5y$

$X = \frac{12 - 5y}{3}$

Substitute x in – eq 2

we get,

$5\times\left(\frac{12-5y}{3}\right) + 3y = 4$

$\frac{60-25y+9y}{3} = 4$

60 – 25y + 9y = 12

60 – 16y = 12

16y = 60 – 12

16y = 48

$y = \frac{48}{16} = 3$

∴ y = 3

Now, substitute y in – eq 1

We get,

3x + 5×3 = 12

3x + 15 = 12

3x = 12 – 15

3x = - 3

$x = \frac{-3}{3} = -1$

∴ x = - 1

∴ x = - 1 and y = 3

Question: 2

Show that each of

Solution:

Given: 2x – 3y = 17 – eq 1

4x + y = 13 – eq 2

Here,

$a_1 = 2$, $b_1 = -3$, $c_1 = 17$

$a_2 = 4$, $b_2 = 1$, $c_2 = 13$

$\frac{a1}{a2} = \frac{1}{2}$, $\frac{b1}{b2} = \frac{-3}{1}$

Here, $\frac{a1}{a2} \neq \frac{b1}{b2}$

∴ Given system of equations have unique solutions.

Now,

In – eq 1

2x = 17 + 3y

$X = \frac{17+3y}{2}$

Substitute x in – eq 2

we get,

$4\times\left(\frac{17+3y}{2}\right) + y = 13$

$\frac{68 + 12y + 2y}{2} = 13$

68 + 12y + 2y = 26

68 + 14y = 26

14y = 26 – 68

14y = - 42

y = $\frac{-42}{14}$ = - 3

∴ y = - 3

Now, substitute y in – eq 1

We get,

2x – 3×(- 3) = 17

2x + 9 = 17

2x = 17 – 9

2x = 8

x = 8/2 = 4

∴ x = 4

∴ x = 4 and y = - 3

Question: 3

Show that each of

Solution:

Given: $\frac{x}{3} + \frac{y}{2} = 3$ ⇒ 2x + 3y = 18 – eq 1

x - 2y = 2 – eq 2

Here,

$a_1 = 2$, $b_1 = 3$, $c_1 = 18$

$a_2 = 1$, $b_2 = - 2$, $c_2 = 2$

$\frac{a1}{a2} = \frac{2}{1}$, $\frac{b1}{b2} = \frac{-3}{2}$

Here, $\frac{a1}{a2} \neq \frac{b1}{b2}$

∴ Given system of equations have unique solutions.

Now,

In – eq 1

2x = 18 – 3y

X = $\frac{18 - 3y}{2}$

Substitute x in – eq 2

we get,

$\left(\frac{18 - 3y}{2}\right)$ – 2y = 2

$\frac{18 - 3y - 4y}{2} = 2$

18 – 3y – 4y = 4

18 – 7y = 4

7y = 18 – 4

7y = 14

$y = \frac{14}{7} = 2$

∴ y = 2

Now, substitute y in – eq 1

We get,

x – 2×(2) = 2

x – 4 = 2

x = 2 + 4

x = 6

∴ x = 6

∴ x = 6 and y = 2

Question: 4

Find the value of

Solution:

Given: 2x + 3y - 5 = 0 – eq 1

kx - 6y - 8 = 0 – eq 2

Here,

$a_1 = 2$, $b_1 = 3$, $c_1 = -5$

$a_2 = k$, $b_2 = -6$, $c_2 = -8$

Given systems of equations has a unique solution

$\therefore \frac{a1}{a2} \neq \frac{b1}{b2}$

$\frac{2}{k} \neq \frac{3}{-6}$

$\frac{2}{k} \neq \frac{-1}{2}$

$2 \neq \frac{-k}{2}$

k ≠ 2× 2 = - 4

∴ k ≠ - 4

Question: 5

Find the value of

Solution:

Given: x - ky = 2 – eq 1

3x + 2y + 5 = 0 – eq 2

Here,

$a_1 = 1$, $b_1 = -k$, $c_1 = -2$

$a_2 = 3, b_2 = 2, c_2 = 5$

Given systems of equations has a unique solution

$\therefore \frac{a1}{a2} \neq \frac{b1}{b2}$

$\frac{1}{3} \neq \frac{-k}{2}$

$2 \neq -3k$

$-3k \neq 2$

$k \neq \frac{-2}{3}$

Question: 6

Find the value of

Solution:

Given: $5x - 7y - 5 = 0$ – eq 1

$2x + ky - 1 = 0$ – eq 2

Here,

$a_1 = 5, b_1 = -7, c_1 = -5$

$a_2 = 2, b_2 = k, c_2 = -1$

Given systems of equations has a unique solution

$\therefore \frac{a1}{a2} \neq \frac{b1}{b2}$

$\frac{5}{2} \neq \frac{-7}{k}$

$5k \neq (-7) \times 2$

$5k \neq -14$

$k \neq \frac{-14}{5}$

$\therefore k \neq \frac{-14}{5}$

Question: 4

Find the value of

Solution:

Given: $4x + ky + 8 = 0$ – eq 1

$x + y + 1 = 0$ – eq 2

Here,

$a_1 = 4, b_1 = k, c_1 = 8$

$a_2 = 1, b_2 = 1, c_2 = 1$

Given systems of equations has a unique solution

$\therefore \frac{a1}{a2} \neq \frac{b1}{b2}$

$\frac{4}{1} \neq \frac{k}{1}$

$4 \neq k$

$\therefore$ k ≠ 4

Question: 8

Find the value of

Solution:

Given: 4x – 5y = k – eq 1

2x – 3y = 12 – eq 2

Here,

$a_1 = 4$, $b_1 = -5$, $c_1 = -k$

$a_2 = 2$, $b_2 = -3$, $c_2 = -12$

Given systems of equations has a unique solution

$\therefore \frac{a1}{a2} \neq \frac{b1}{b2}$

$\frac{4}{2} \neq \frac{-5}{-3}$

Here, the system of equations have unique solutions, irrespective of the value of k.

That is solution of the given system of equations is independent of the value of k.

$\therefore$ k is any real number

Question: 9

Find the value of

Solution:

Given: kx + 3y = (k – 3) – eq 1

12x + ky = k – eq 2

Here,

$a_1 = k$, $b_1 = 3$, $c_1 = k - 3$

$a_2 = 12$, $b_2 = k$, $c_2 = k$

Given systems of equations has a unique solution

$\therefore \frac{a1}{a2} \neq \frac{b1}{b2}$

$\frac{k}{12} \neq \frac{3}{k}$

$K^2 \neq 36$

$k \neq \sqrt{36}$

$\therefore k \neq \pm 6$

$\therefore$ k ≠ 6 and k ≠ – 6

That is k can be any real number other than - 6 and 6

$\therefore$ k is any real number other than 6 and - 6

Question: 10

Show that the sys

Solution:

Given: 2x – 3y = 5 – eq 1

6x – 9y = 15 – eq 2

Here,

$a_1 = 2$, $b_1 = -3$, $c_1 = 5$

$a_2 = 6$, $b_2 = -9$, $c_2 = 15$

Here,

$\frac{a1}{a2} = \frac{2}{6} = \frac{1}{3}$

$\frac{b1}{b2} = \frac{-3}{-9} = \frac{1}{3}$

$\frac{c1}{c2} = \frac{5}{15} = \frac{1}{3}$

Here,

$\frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2}$

∴ The given system of equations has infinite number of solutions.

Question: 11

Show that the sys

Solution:

Given: $6x + 5y = 11$ – eq 1

$9x + \frac{15}{2}y = 21 \Rightarrow 18x + 15y = 42$ – eq 2

Here,

$a_1 = 6$, $b_1 = 5$, $c_1 = -11$

$a_2 = 18$, $b_2 = 15$, $c_2 = -42$

Here,

$\frac{a1}{a2} = \frac{6}{18} = \frac{1}{3}$

$\frac{b1}{b2} = \frac{5}{15} = \frac{1}{3}$

$\frac{c1}{c2} = \frac{-11}{-42} = \frac{11}{42}$

Here,

$\frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$

That is give system of equations are parallel lines, that is they don’t have any solutions.

∴ The system of equations has no solution.

Question: 12

For what value of

Solution:

(i) Given: $kx + 2y = 5$ – eq 1

$3x - 4y = 10$ – eq 2

Here,

$a_1 = k$, $b_1 = 2$, $c_1 = 5$

$a_2 = 3$, $b_2 = -4$, $c_2 = 10$

Given systems of equations has a unique solution

$\therefore \frac{a1}{a2} \neq \frac{b1}{b2}$

$\frac{k}{3} \neq \frac{2}{-4}$

$-4k \neq 6$

$k \neq \frac{6}{-4}$

$\therefore k \neq \frac{-3}{2}$

(ii) Given: kx + 2y = 5 – eq 1

3x – 4y = 10 – eq 2

Here,

$a_1 = k, b_1 = 2, c_1 = 5$

$a_2 = 3, b_2 = -4, c_2 = 10$

Given that systems of equations has no solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$

Here,

$\frac{k}{3} = \frac{2}{-4}$

Here,

$-4k = 6$

$\therefore k = \frac{-3}{2}$

Question: 13

For what value of

Solution:

(i) Given: x + 2y = 5 – eq 1

3x + ky + 15 = 0 – eq 2

Here,

$a_1 = 1, b_1 = 2, c_1 = -5$

$a_2 = 3, b_2 = k, c_2 = 15$

Given systems of equations has a unique solution

$\therefore \frac{a1}{a2} \neq \frac{b1}{b2}$

$\frac{1}{3} \neq \frac{2}{k}$

$k \neq 6$

$\therefore k \neq 6$

(ii) Given: x + 2y = 5 – eq 1

3x + ky + 15 = 0 – eq 2

Here,

$a_1 = 1, b_1 = 2, c_1 = - 5$

$a_2 = 3, b_2 = k, c_2 = 15$

Given that systems of equations has no solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$

Here,

$\frac{1}{3} = \frac{2}{k}$

Here,

k = 6

$\therefore$ k = 6

Question: 14

For what value of

Solution:

(i) Given: x + 2y = 3 – eq 1

5x + ky + 7 = 0 – eq 2

Here,

$a_1 = 1, b_1 = 2, c_1 = - 3$

$a_2 = 5, b_2 = k, c_2 = 7$

Given systems of equations has a unique solution

$\therefore \frac{a1}{a2} \neq \frac{b1}{b2}$

$\frac{1}{5} \neq \frac{2}{k}$

k ≠10

$\therefore$ k ≠ 10

(ii) Given: x + 2y = 3 – eq 1

5x + ky + 7 = 0 – eq 2

Here,

$a_1 = 1, b_1 = 2, c_1 = - 3$

$a_2 = 5, b_2 = k, c_2 = 7$

Given that system of equations has no solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$

Here,

$\frac{1}{5} = \frac{2}{k}$

Here,

k = 10

$\therefore$ k = 10

For the system of equations to have infinitely many solutions

$\frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2}$

$\frac{1}{5} = \frac{2}{k} = \frac{-3}{7}$ which is wrong.

That is, for any value of k the give system of equations cannot have infinitely many solutions.

Question: 15

Find the value of

Solution:

Given: 2x + 3y = 7 – eq 1

(k - 1)x + (k + 2)y = 3k – eq 2

Here,

$a_1 = 2$, $b_1 = 3$, $c_1 = 7$

$a_2 = k - 1$, $b_2 = k + 2$, $c_2 = 3k$

Given that system of equations has infinitely many solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2}$

$\frac{2}{k-1} = \frac{3}{k+2} = \frac{7}{3k}$

Here,

$\frac{2}{k-1} = \frac{3}{k+2}$

2×(k + 2) = 3×(k - 1)

2k + 4 = 3k – 3

3k – 2k = 4 + 3

K = 7

∴ k = 7

Question: 16

Find the value of

Solution:

Given: 2x + (k – 2)y = k – eq 1

6x + (2k – 1)y = (2k + 5) – eq 2

Here,

$a_1 = 2$, $b_1 = k – 2$, $c_1 = k$

$a_2 = 6$, $b_2 = 2k – 1$, $c_2 = 2k + 5$

Given that system of equations has infinitely many solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2}$

$\frac{2}{6} = \frac{k-2}{2k-1} = \frac{k}{2k+5}$

Here,

$\frac{2}{6} = \frac{k-2}{2k-1}$

2×(2k – 1) = 6×(k - 2)

4k – 2 = 6k – 12

12 – 2 = 6k – 4k

2k = 10

K = 5

∴ k = 5

Question: 17

Find the value of

Solution:

Given: kx + 3y = (2k + 1) – eq 1

2(k + 1)x + 9y = (7k + 1) – eq 2

Here,

a_1 = k, b_1 = 3, c_1 = - (2k + 1)

a_2 = 2(k + 1) , b_2 = 9 , c_2 = - (7k + 1)

Given that system of equations has infinitely many solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2}$

$\frac{k}{2(k+1)} = \frac{3}{9} = \frac{-(2k+1)}{-(7k+1)}$

Here,

$\frac{k}{2(k+1)} = \frac{3}{9}$

9k = 6×(k + 1)

9k = 6k + 6

9K – 6k = 6

3k = 6

K = $\frac{6}{3}$

K = 2

∴ k = 2

Question: 18

Find the value of

Solution:

Given: 5x + 2y = 2k – eq 1

2(k + 1)x + ky = (3k + 4) – eq 2

Here,

a_1 = 5, b_1 = 2, c_1 = - 2k

a_2 = 2(k + 1) , b_2 = k, c_2 = - (3k + 4)

Given that system of equations has infinitely many solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2}$

$\frac{5}{2(k+1)} = \frac{2}{k} = \frac{-2k}{-(3k+4)}$

Here,

$\frac{5}{2(k+1)} = \frac{2}{k}$

5k = 4×(k + 1)

5k = 4k + 4

5K – 4k = 4

k = 4

∴ k = 4

Question: 19

Find the value of

Solution:

Given: (k – 1)x – y = 5 – eq 1

(k + 1)x + (1 – k)y = (3k + 1) – eq 2

Here,

a_1 = (k - 1), b_1 = - 1, c_1 = - 5

a_2 = (k + 1) , b_2 = (1 - k), c_2 = - (3k + 1)

Given that system of equations has infinitely many solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2}$

$\frac{(k-1)}{(k+1)} = \frac{-1}{1-k} = \frac{-5}{-(3k+1)}$

Here,

$\frac{-1}{1-k} = \frac{-5}{-(3k+1)}$

(3k + 1) = - 5×(1 - k)

3k + 1 = - 5 + 5k

5K – 3k = 1 + 5

2k = 6

k = $\frac{6}{2}$

k = 3

∴ k = 3

Question: 20

Find the value of

Solution:

Given: (k – 3)x + 3y = k – eq 1

kx + ky = 12 – eq 2

Here,

a_1 = (k - 3), b_1 = 3, c_1 = - k

a_2 = k , b_2 = k, c_2 = - 12

Given that system of equations has infinitely many solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2}$

$\frac{(k-3)}{k} = \frac{3}{k} = \frac{-k}{-12}$

Here,

$\frac{3}{k} = \frac{-k}{-12}$

$3\times(-12) = -k\times(k)$

$-36 = -k^2$

$K^2 = 36$

$k = \sqrt{36}$

$k = \pm 6$

k = 6 and k = - 6 – eq 3

Also,

$\frac{(k-3)}{k} = \frac{3}{k}$

$K(k - 3) = 3k$

$K^2 - 3k = 3k$

$K^2 - 6k = 0$

$K(k - 6) = 0$

K = 0 and k = 6 – eq 4

From – eq 3 and – eq 4

k = 6

∴ k = 6

Question: 21

Find the values o

Solution:

Given: $(a - 1)x + 3y = 2$ – eq 1

$6x + (1 - 2b)y = 6$ – eq 2

Here,

$a_1 = (a - 1)$, $b_1 = 3$, $c_1 = -2$

$a_2 = 6$, $b_2 = (1 - 2b)$, $c_2 = -6$

Given that system of equations has infinitely many solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2}$

$\frac{(a-1)}{6} = \frac{3}{(1-2b)} = \frac{-2}{-6}$

Here,

$\frac{3}{(1-2b)} = \frac{-2}{-6}$

$3\times(-6) = (1 - 2b)\times(-2)$

$-18 = -2 + 4b$

$4b = -18 + 2$

$4b = -16$

$b = \frac{-16}{4}$

b = - 4

Also,

$\frac{(a-1)}{6} = \frac{-2}{-6}$

- 6(a - 1) = - 2×6

- 6a + 6 = - 12

- 6a = - 12 - 6

- 6a = - 18

$a = \frac{-18}{-6}$

a = 3

∴ a = 3

∴ a = 3, b = - 4

Question: 22

Find the values o

Solution:

Given: (2a - 1)x + 3y = 5 – eq 1

3x + (b - 1)y = 2 – eq 2

Here,

$a_1 = (2a - 1)$, $b_1 = 3$, $c_1 = - 5$

$a_2 = 3$, $b_2 = (b - 1)$, $c_2 = - 2$

Given that system of equations has infinitely many solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2}$

$\frac{(2a-1)}{3} = \frac{3}{(b-1)} = \frac{-5}{-2}$

Here,

$\frac{(2a-1)}{3} = \frac{-5}{-2}$

- 2×(2a - 1) = 3×(- 5)

- 4a + 2 = - 15

- 4a = - 15 - 2

- 4a = - 17

$b = \frac{-17}{-4}$

$\therefore b = - \frac{17}{4}$

Also,

$\frac{3}{(b-1)} = \frac{-5}{-2}$

3(- 2) = - 5×(b - 1)

- 6 = - 5b + 5

$5b = 5 + 6$

$5b = 11$

$b = \frac{11}{5}$

$\therefore b = \frac{11}{5}$

$\therefore a = \frac{11}{5}, b = \frac{11}{5}$

Question: 23

Find the values o

Solution:

Given: $2x - 3y = 7$ – eq 1

$(a + b)x - (a + b - 3)y = 4a + b$ – eq 2

Here,

$a_1 = 2, b_1 = -3, c_1 = -7$

$a_2 = (a + b), b_2 = -(a + b - 3), c_2 = -(4a + b)$

Given that system of equations has infinitely many solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2}$

$\frac{2}{(a+b)} = \frac{-3}{-(a+b-3)} = \frac{-7}{-(4a+b)}$

Here,

$\frac{-3}{-(a+b-3)} = \frac{-7}{-(4a+b)}$

$-3\times(-4a + b) = -7\times-(a + b - 3)$

$12a + 3b = 7a + 7b - 21$

$12a - 7a = -3b + 7b - 21$

$5a = 4b - 21$

$5a - 4b + 21 = 0$ —eq 3

Also,

$\frac{2}{(a+b)} = \frac{-7}{-(4a+b)}$

$2\times-(4a + b) = -7\times(a + b)$

$-8a - 2b = -7a - 7b$

$-8a + 7a = 2b - 7b$

$-a = -5b$

$a = 5b$ —eq 4

substitute – eq 4 in – eq 3

$5(5b) - 4b + 21 = 0$

$25b - 4b + 21 = 0$

$21b + 21 = 0$

$b = \frac{-21}{21}$

b = - 1

substitute 'b' in – eq 4

a = 5(- 1)

a = - 5

∴ a = - 5, b = - 1

Question: 24

Find the values o

Solution:

Given: 2x + 3y = 7 – eq 1

(a + b + 1)x + (a + 2b + 2)y = 4(a + b) + 1 – eq 2

Here,

$a_1 = 2$, $b_1 = 3$, $c_1 = -7$

$a_2 = (a + b + 1)$, $b_2 = (a + 2b + 2)$, $c_2 = -(4(a + b) + 1)$

Given that system of equations has infinitely many solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2}$

$\frac{2}{(a+b+1)} = \frac{3}{(a+2b+2)} = \frac{-7}{-(4(a+b)+1)}$

Here,

$\frac{3}{(a+2b+2)} = \frac{-7}{-(4(a+b)+1)}$

3× - (4(a + b) + 1) = - 7×(a + 2b + 2)

- 12a - 12b - 3 = - 7a - 14b - 14

- 12a + 7a - 3 = 12b - 14b - 14

- 5a - 3 = - 2b - 14

5a - 2b - 11 = 0 —eq 3

Also,

$\frac{2}{(a+b+1)} = \frac{-7}{-(4(a+b)+1)}$

2× - (4(a + b) + 1) = - 7×(a + b + 1)

- 8a – 8b – 2 = - 7a – 7b – 7

- 8a + 7a = 8b – 7b – 7 + 2

- a = b – 5

a + b = 5

a = 5 – b —eq 4

substitute – eq 4 in – eq 3

5(5 – b) - 2b - 11 = 0

25 – 5b - 2b - 11 = 0

- 7b + 14 = 0

$b = \frac{-14}{-7}$

b = 2

substitute ‘b’ in – eq 4

a = 5 - 2

a = 3

∴a = 3, b = 2

Question: 25

Find the values o

Solution:

Given: 2x + 3y = 7 – eq 1

(a + b)x + (2a - b)y = 21 – eq 2

Here,

$a_1 = 2$, $b_1 = 3$, $c_1 = -7$

$a_2 = (a + b)$, $b_2 = (2a – b)$, $c_2 = -21$

Given that system of equations has infinitely many solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2}$

$\frac{2}{(a+b)} = \frac{3}{(2a-b)} = \frac{-7}{-21}$

Here,

$\frac{3}{(2a-b)} = \frac{-7}{-21}$

3× - 21 = - 7×(2a - b)

- 63 = - 14a + 7b

14a - 7b - 63 = 0

2a – b – 9 = 0 –eq 3

Also,

$\frac{2}{(a+b)} = \frac{-7}{-21}$

2× - 21 = - 7×(a + b)

- 42 = - 7a – 7b

7a + 7b + 42 = 0

a + b + 6 = 0

a + b = 6

a = 6 – b –eq 4

substitute – eq 4 in – eq 3

2(6 – b) – b – 9 = 0

12 – 2b – b – 9 = 0

- 3b + 3 = 0

$b = \frac{-3}{-3}$

b = 1

substitute 'b' in – eq 4

a = 6 - 1

a = 5

∴ a = 5, b = 1

Question: 26

Find the values o

Solution:

Given: 2x + 3y = 7 – eq 1

2ax + (a + b)y = 28 – eq 2

Here,

a_1 = 2, b_1 = 3, c_1 = - 7

a_2 = 2a, b_2 = (a + b), c_2 = - 28

Given that system of equations has infinitely many solution

∴ $\frac{a1}{a2} = \frac{b1}{b2} = \frac{c1}{c2}$

$\frac{2}{2a} = \frac{3}{(a+b)} = \frac{-7}{-28}$

Here,

$\frac{3}{(a+b)} = \frac{-7}{-28}$

3× - 28 = - 7×(a + b)

- 84 = – 7a – 7b

7a + 7b – 84 = 0

a + b – 12 = 0 —eq 3

Also,

$\frac{2}{2a} = \frac{-7}{-28}$

2× - 28 = - 7×2a

– 56 = – 14a

14a = 56

a = $\frac{56}{14}$

a = 4 —eq 4

substitute – eq 4 in – eq 3

4 + b – 12 = 0

a + b – 12 = 0

b – 8 = 0

b = 8

∴ a = 4, b = 8

Question: 27

Find the value of

Solution:

Given: $8x + 5y = 9$ – eq 1

$kx + 10y = 15$ – eq 2

Here,

$a_1 = 8, b_1 = 5, c_1 = -9$

$a_2 = k, b_2 = 10, c_2 = -15$

Here,

Given that system of equations has no solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$

$\frac{8}{k} = \frac{5}{10} \neq \frac{-9}{-15}$

Here,

$\frac{8}{k} = \frac{5}{10}$

$8 \times 10 = 5 \times k$

$5k = 80$

$K = \frac{80}{5}$

$k = 16$

$\therefore k = 16$

Question: 28

Find the value of

Solution:

Given: $kx + 3y = 3$ – eq 1

$12x + ky = 6$ – eq 2

Here,

$a_1 = k, b_1 = 3, c_1 = -3$

$a_2 = 12, b_2 = k, c_2 = -6$

Here,

Given that system of equations has no solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$

$\frac{k}{12} = \frac{3}{k} \neq \frac{-3}{-6}$

Here,

$\frac{k}{12} = \frac{3}{k}$

$k \times k = 3 \times 12$

$k^2 = \sqrt{36}$

$K = \pm 6$ –eq 3

Also,

$\frac{3}{k} \neq \frac{-3}{-6}$

$3\times - 6 \neq - 3\times k$

$- 18 \neq - 3k$

$3k\neq18$

$K\neq6$ —eq 4

From —eq 3 and —eq 4 we can conclude

$K = -6$

$\therefore k = - 6$

Question: 29

Find the value of

Solution:

Given: $3x - y - 5 = 0$ – eq 1

$6x - 2y + k = 0$ – eq 2

Here,

$a_1 = 3, b_1 = - 1, c_1 = - 5$

$a_2 = 6, b_2 = - 2, c_2 = k$

Here,

Given that system of equations has no solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$

$\frac{3}{6} = \frac{-1}{-2} \neq \frac{-5}{k}$

Here,

$\frac{-1}{-2} \neq \frac{-5}{k}$

$- k \neq - 2\times - 5$

$- k\neq - 10$

$K\neq10$

$\therefore k\neq - 10$Therefore, for $k = 10$, system has no solution.

Question: 30

Find the value of

Solution:

Given: $kx + 3y = k - 3$ – eq 1

$12x + ky = k$ – eq 2

Here,

$a_1 = k, b_1 = 3, c_1 = - (k - 3)$

$a_2 = 12, b_2 = k, c_2 = - k$

Here,

Given that system of equations has no solution

$\therefore \frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$

$\frac{k}{12} = \frac{3}{k} \neq \frac{-(k-3)}{-k}$

Here,

$\frac{k}{12} = \frac{3}{k}$

k×k = 3×12

$k^2 = \sqrt{36}$

K = ±6 –eq 3

Also,

$\frac{3}{k} \neq \frac{-(k-3)}{-k}$

3× - k ≠ - (k - 3)× k

$- 3k \neq - k^2 + 3k$

$K^2 - 3k - 3k \neq 0$

$K^2 - 6k \neq 0$

K(k - 6) ≠0

K ≠ 0 and k ≠ 6 –eq 4

From –eq 3 and –eq 4 we can conclude

K = –6

∴ k = - 6

Question: 31

Find the value of

Solution:

Given: 5x - 3y = 0 – eq 1

2x + ky = 0 – eq 2

Here,

$a_1 = 5$, $b_1 = - 3$, $c_1 = 0$

$a_2 = 2$, $b_2 = k$, $c_2 = 0$

Here,

Given that system of equations has non zero solution.

$\therefore \frac{a1}{a2} = \frac{b1}{b2}$

$\frac{5}{2} = \frac{-3}{k}$

Here,

$\frac{5}{2} = \frac{-3}{k}$

5×k = - 3×2

5k = –6

$K = \frac{-6}{5}$

$\therefore k = \frac{-6}{5}$

Exercise : 3E

Question: 1

5 chairs and 4 ta

Solution:

Let the cost of each chair and each table are x and y respectively.

According to question,

5 × (cost of each chair) + 4 × (cost of each table) = 5600, and

4 × (cost of each chair) + 3 × (cost of each table) = 4340

∴ 5x + 4y = 5600.....(1)

4x + 3y = 4340.....(2)

from equation (1), we get -

x = (5600 - 4y)/5.....(3)

substituting the value of x in equation (2), we get -

$4\left(\frac{5600-4y}{5}\right) + 3y = 4340$

$\Rightarrow 4480 - \frac{16}{5}y + 3y = 4340$

⇒ 1/5 y = 140

∴ y = 700

substituting the value of y in equation (3), we get -

x = 560

Thus the cost of each chair is Rs. 560 and that of a table is Rs. 700.

Question: 2

23 spoons and 17

Solution:

Let the cost of each spoon and each fork are x and y respectively.

According to question,

23 × (cost of each spoon) + 17 × (cost of each fork) = 1770, and

17 × (cost of each spoon) + 23 × (cost of each fork) = 1830

∴ 23x + 17y = 1770.....(1)

17x + 23y = 1830.....(2)

from equation (1), we get -

x = (1770 - 17y)/23.....(3)

substituting the value of x in equation (2), we get -

$17\left(\frac{1770-17y}{23}\right) + 23y = 1830$

$\Rightarrow \frac{30090}{23} - \frac{289}{23}y + 23y = 1830$

$\Rightarrow \frac{30090}{23} + \frac{240}{23}y = 1830$

⇒ 30090 + 240y = 42090

⇒ 240y = 12000

∴ y = 50

substituting the value of y in equation (3), we get -

x = 40

Thus the cost of each spoon is Rs. 40 and that of a fork is Rs. 50.

Question: 3

A lady has only 2

Solution:

Let the no. of 25 - paisa coins be x.

∴ the no of 50 - paisa coins = 50 - x

[∵ the total no. of coins = 50]

According to the question,

total money = Rs. 19.50 = 1950 paise

∴ 25x + 50(50 - x) = 1950

⇒ 2500 - 25x = 1950

⇒ 25x = 550

∴ x = 22

Thus, the no of 25 - paisa coins = x = 22 and,

the no of 50 - paisa coins = 50 - x = 50 - 22 = 28.

Question: 4

The sum of two nu

Solution:

Let the two numbers be x and y.

According to question -

x + y = 137.....(1)

x - y = 43.....(2)

Adding equations (1) and (2) , we get -

2x = 180

∴ x = 90

substituting the value of x in equation (2), we get -

y = 90 - 43 = 47

Thus, the numbers are 90 and 47.

Question: 5

Find two numbers

Solution:

Let the two numbers be x and y.

According to question -

2x + 3y = 92.....(1)

4x - 7y = 2.....(2)

From equation (1), we get -

x = (92 - 3y)/2.....(3)

Substituting the value of x in equation (2), we get -

$$4\left(\frac{92-3y}{2}\right) - 7y = 2$$

⇒ 184 - 6y - 7y = 2

⇒ 13y = 182

∴ y = 14

substituting the value of y in equation (3), we get -

x = 25

Thus, the numbers are 25 and 14.

Question: 6

Find two numbers

Solution:

Let the two numbers be x and y.

According to question -

3x + y = 142.....(1)

4x - y = 138.....(2)

Adding equations (1) and (2) , we get -

7x = 280

∴ x = 40

substituting the value of x in equation (2), we get -

y = 142 - 3x = 142 - 120 = 22

Thus, the numbers are 40 and 22.

Question: 7

If 45 is subtract

Solution:

Let the greater number be x and the smaller number be y.

According to question -

2x - 45 = y

⇒ 2x - y = 45.....(1)

and, 2y - 21 = x

⇒ x - 2y = - 21.....(2)

From equation (1), we get -

x = (y + 45)/2.....(3)

Substituting the value of x in equation (2), we get -

$$\left(\frac{y + 45}{2}\right) - 2y = -21$$

$$\Rightarrow \frac{y + 45 - 4y}{2} = -21$$

⇒ 45 - 3y = - 42

⇒ 3y = 87

∴ y = 29

substituting the value of y in equation (3), we get -

x = 37

Thus, the numbers are 37 and 29.

Question: 8

If three times th

Solution:

Let the Larger number be x and the smaller number be y.

We know that -

Dividend = Quotient × Divisor + Remainder

According to question -

3x = 4y + 8

⇒ 3x - 4y = 8.....(1)

and, 5y = 3x + 5

⇒ - 3x + 5y = 5.....(2)

From equation (1), we get -

x = (4y + 8)/3.....(3)

Substituting the value of x in equation (2), we get -

$$-3\left(\frac{4y + 8}{3}\right) + 5y = 5$$

$$\Rightarrow \frac{-12y - 24 + 15y}{3} = 5$$

$$\Rightarrow \frac{3y - 24}{3} = 5$$

⇒ y - 8 = 5

∴ y = 13

substituting the value of y in equation (3), we get -

x = 20

Thus, the numbers are 20 and 13.

Question: 9

If 2 is added to

Solution:

Let the two numbers be x and y.

According to question -

$$\frac{x + 2}{y + 2} = \frac{1}{2}$$

On Cross multiplying, we get -

⇒ $2x + 4 = y + 2$

⇒ $2x - y = - 2$.....(1)

and,

$$\frac{x - 4}{y - 4} = \frac{5}{11}$$

⇒ $11x - 44 = 5y - 20$

⇒ $11x - 5y = 24$

From equation (1), we get -

$x = (y - 2)/2$

Substituting the value of x in equation (2), we get -

$$11\left(\frac{y - 2}{2}\right) - 5y = 24$$

⇒ $y - 22 = 48$

∴ $y = 70$

substituting the value of y in equation (3), we get -

$x = 34$

Thus, the numbers are 34 and 70.

Question: 10

The difference be

Solution:

Let the two numbers be x and y.

According to question -

$x - y = 14$.....(1)

$x^2 - y^2 = 448$.....(2)

From equation (1), we get -

$x = y + 14$.....(3)

Substitute the value of x in equation (2), we get -

$(y + 14)^2 - y^2 = 448$

⇒ $28y + 196 = 448$

⇒ $28y = 252$

∴ $y = 9$

Substitute the value of y in equation (3), we get -

$x = 23$

Thus, the numbers are 23 and 9.

Question: 11

The sum of the di

Solution:

Let the two - digit number be xy (i.e. $10x + y$).

After interchanging the digits of the number xy, the new number becomes yx (i.e. $10y + x$).

According to question -

sum of the digits is 12

$\Rightarrow x + y = 12$.....(1)

Also, the number obtained by interchanging its digits exceeds the given number by 18

$\Rightarrow (10y + x) - (10x + y) = 18$

$\Rightarrow -9x + 9y = 18$

$\Rightarrow -x + y = 2$.....(2)

Adding equations (1) and (2), we get -

$x + y - x + y = 10 + 4 \Rightarrow 2y = 14 \Rightarrow y = 7$

Substitute the value of y in equation (1), we get -

$x = 5$

Thus, the required number is 57.

Question: 12

A number consisti

Solution:

Let the two - digit number be xy (i.e. $10x + y$).

After reversing the digits of the number xy, the new number becomes yx (i.e. $10y + x$).

According to question -

$(10x + y) = 7(x + y)$

$\Rightarrow 3x = 6y$

$\Rightarrow x = 2y$.....(1)

and,

$(10x + y) - 27 = (10y + x)$

$\Rightarrow 9x - 9y = 27$

$\Rightarrow x - y = 3$.....(2)

Substituting equation (1) into (2), we get -

$y = 3$

Substitute the value of y in equation (1), we get -

$x = 6$

Thus, the required number is 63.

Question: 13

The sum of the di

Solution:

Let the two - digit number be xy (i.e. $10x + y$).

After interchanging the digits of the number xy, the new number becomes yx (i.e. $10y + x$).

According to question -

$x + y = 15$.....(1)

$(10y + x) - (10x + y) = 9$

$\Rightarrow -9x + 9y = 9$

$\Rightarrow -x + y = 1$.....(2)

Adding equations (1) and (2), we get -

$y = 8$

Substitute the value of y in equation (1), we get -

$x = 7$

Thus, the required number is 78.

Question: 14

A two - digit num

Solution:

Let the two - digit number be xy (i.e. $10x + y$).

After reversing the digits of the number xy, the new number becomes yx (i.e. $10y + x$).

According to question -

$(10x + y) = 4(x + y) + 3$

$\Rightarrow 6x - 3y = 3$

$\Rightarrow 2x - y = 1$.....(1)

and,

$(10x + y) + 18 = (10y + x)$

$\Rightarrow 9x - 9y = -18$

$\Rightarrow x - y = -2$.....(2)

Subtracting equation (2) from (1), we get -

$x = 3$

Substitute the value of x in equation (1), we get -

$y = 5$

Thus, the required number is 35.

Question: 15

A number consists

Solution:

Let the two - digit number be xy (i.e. $10x + y$).

After reversing the digits of the number xy, the new number becomes yx (i.e. $10y + x$).

We know that -

Dividend = Quotient × Divisor + Remainder

According to question -

$(10x + y) = 6(x + y)$

$\Rightarrow 4x = 5y$

$\Rightarrow x = (5/4)y$.....(1)

and,

$(10x + y) - 9 = (10y + x)$

$\Rightarrow 9x - 9y = 9$

$\Rightarrow x - y = 1$.....(2)

Substituting the value of x in equation (2), we get -

$y = 4$

Substitute the value of y in equation (1), we get -

$x = 5$

Thus, the number is 54.

Question: 16

A two - digit num

Solution:

Let the two - digit number be xy (i.e. $10x + y$).

After reversing the digits of the number xy, the new number becomes yx (i.e. $10y + x$).

According to question -

$xy = 35$

$\Rightarrow x = 35/y$.....(1)

and,

$(10x + y) + 18 = (10y + x)$

$\Rightarrow 9x - 9y = -18$

$\Rightarrow x - y = -2$.....(2)

Substituting the value of x in equation (2), we get -

$$\frac{35}{y} - y = -2$$

$\Rightarrow 35 - y^2 = -2y$

$\Rightarrow y^2 - 2y - 35 = 0$

$\Rightarrow y^2 - 7y + 5y - 35 = 0$

$\Rightarrow y(y - 7) + 5(y - 7) = 0$

$\Rightarrow (y + 5)(y - 7) = 0$

$\therefore y = 7$

[$y = -5$ is invalid because digits of a number cannot be negative.]

Substituting the value of y in equation (1), we get -

$x = 5$

Thus, the required number is 57.

Question: 17

A two - digit num

Solution:

Let the two - digit number be xy (i.e. $10x + y$).

After reversing the digits of the number xy, the new number becomes yx (i.e. $10y + x$).

According to question -

$xy = 18$

$\Rightarrow x = 18/y$.....(1)

and,

$(10x + y) - 63 = (10y + x)$

$\Rightarrow 9x - 9y = 63$

$\Rightarrow x - y = 7$.....(2)

Substituting the value of x in equation (2), we get -

$$\frac{18}{y} - y = 7$$

$\Rightarrow 18 - y^2 = 7y$

$\Rightarrow y^2 + 7y - 18 = 0$

$\Rightarrow y^2 + 9y - 2y - 18 = 0$

$\Rightarrow y(y + 9) - 2(y + 9) = 0$

$\Rightarrow (y + 9)(y - 2) = 0$

$\therefore y = 2$

[y = - 9 is invalid because digits of a number cannot be negative.]

Substituting the value of y in equation (1), we get -

$x = 9$

Thus, the required number is 92.

Question: 18

The sum of a two

Solution:

Let the two - digit number be xy (i.e. $10x + y$).

After reversing the digits of the number xy, the new number becomes yx (i.e. $10y + x$).

According to question -

$(10x + y) + (10y + x) = 121$

$\Rightarrow 11x + 11y = 121$

$\Rightarrow x + y = 11$.....(1)

and,

$x - y = 3$ or $y - x = 3$

[as we don't know which digit is greater out of x and y]

$\Rightarrow x - y = \pm 3$.....(2)

Adding Equation (1) and (2), we get -

$2x = 14$ or 8

$\Rightarrow x = 7$ or 4

Case 1. when $x = 7$

$y = 4$ [from equation (1)]

Case 2. when $x = 4$

y = 7 [from equation (1)]

Thus, the possible numbers are 47 or 74.

Question: 19

The sum of the nu

Solution:

Let the fraction be x/y.

According to question -

x + y = 8.....(1)

and,

$$\frac{x + 3}{y + 3} = \frac{3}{4}$$

On Cross multiplying, we get -

⇒ 4x + 12 = 3y + 9

⇒ 4x - 3y = - 3.....(2)

From equation (1), we get -

x = 8 - y.....(3)

Substituting the value of x in equation (2), we get -

4(8 - y) - 3y = - 3

⇒ 7y = 35

∴ y = 5

substituting the value of y in equation (3), we get -

x = 3

Thus, the required fraction is 3/5.

Question: 20

If 2 is added to

Solution:

Let the fraction be x/y.

According to question -

$$\frac{x + 2}{y} = \frac{1}{2}$$

On Cross multiplying, we get -

⇒ 2x + 4 = y.....(1)

and,

$$\frac{x}{y - 1} = \frac{1}{3}$$

On Cross multiplying, we get -

3x = y - 1

⇒ 3x + 1 = y.....(2)

Comparing L.H.S of equation (1) and equation (2), we get -

2x + 4 = 3x + 1

⇒ x = 3

Substituting the value of x in equation (2), we get -

y = 10

Thus, the required fraction is 3/10.

Question: 21

The denominator o

Solution:

Let the fraction be x/y.

According to question -

- x + y = 11.....(1)

and,

$$\frac{x + 8}{y + 8} = \frac{3}{4}$$

On Cross multiplying, We get -

⇒ 4x + 32 = 3y + 24

⇒ 4x - 3y = - 8.....(2)

From equation (1), we get -

x = y - 11.....(3)

Substituting the value of x in equation (2), we get -

4(y - 11) - 3y = - 8

⇒ y = 36

substituting the value of y in equation (3), we get -

x = 25

Thus, the required fraction is 25/36.

Question: 22

Find a fraction w

Solution:

Let the fraction be x/y.

According to question -

$$\frac{x - 1}{y + 2} = \frac{1}{2}$$

On Cross multiplying, we get -

⇒ 2x - 2 = y + 2

⇒ 2x - y = 4.....(1)

and,

$$\frac{x - 7}{y - 2} = \frac{1}{3}$$

On Cross multiplying, we get -

3x - 21 = y - 2

⇒ 3x - y = 19.....(2)

Subtracting equation (1) from equation (2), we get -

⇒ $x = 15$

Substituting the value of x in equation (1), we get -

$y = 26$

Thus, the required fraction is 15/26.

Question: 23

The sum of the nu

Solution:

Let the fraction be x/y.

According to question -

$x + y = 4 + 2x$

⇒ $- x + y = 4$.....(1)

and,

$$\frac{x + 3}{y + 3} = \frac{2}{3}$$

On Cross multiplying, we get -

⇒ $3x + 9 = 2y + 6$

⇒ $3x - 2y = - 3$.....(2)

From equation (1), we get -

$x = y - 4$ .....(3)

Substituting the value of x in equation (2), we get -

$3(y - 4) - 2y = - 3$

⇒ $y = 9$

Substituting the value of y in equation (3), we get -

$x = 5$

Thus, the required fraction is 5/9.

Question: 24

The sum of two nu

Solution:

Let the two numbers be x and y.

According to question -

$x + y = 16$.....(1)

and,

$$\frac{1}{x} + \frac{1}{y} = \frac{1}{3}$$

$$\Rightarrow \frac{x + y}{xy} = \frac{1}{3}$$

⇒ $3x + 3y = xy$.....(2)

From equation (1), we get -

$x = 16 - y$.....(3)

Substitute the value of x in equation (2), we get -

$3(16 - y) + 3y = (16 - y)y$

$\Rightarrow 48 = 16y - y^2$

$\Rightarrow y^2 - 16y + 48 = 0$

$\Rightarrow y^2 - 12y - 4y + 48 = 0$

$\Rightarrow y(y - 12) - 4(y - 12) = 0$

$\Rightarrow (y - 4)(y - 12) = 0$

$\Rightarrow y = 4$ or $y = 12$

Case 1. When $y = 4$

$x = 12$ [from equation (3)]

Case 2. When $y = 12$

$x = 4$ [from equation (3)]

Thus, the possible values are 12 and 4.

Question: 25

There are two cla

Solution:

Let initially the number of students in classroom A and B be x and y respectively.

According to question -

$x - 10 = y + 10$

$\Rightarrow x - y = 20$.....(1)

and,

$x + 20 = 2(y - 20)$

$\Rightarrow x - 2y = - 60$.....(2)

Subtracting equation (2) from (1), we get -

$y = 80$

substitute the value of y in equation (1), we get -

$x = 100$

Thus, No. of students in classroom A is 100 and in B is 80.

Question: 26

Taxi charges in a

Solution:

Let the fixed charge of taxi be x.

Excluding fixed charge, a man pays Rs. (1330 - x) for 80 km and Rs. (1490 - x) for 90 km distance.

∴ Rate per km is given by -

$$\frac{1330 - x}{80} = \frac{1490 - x}{90}$$

On Cross multiplying, we get -

$\Rightarrow 90(1330 - x) = 80(1490 - x)$

$\Rightarrow 119700 - 90x = 119200 - 80x$

⇒ 10x = 500

⇒ x = 50

Hence, the fixed charge = Rs. 50

and, Rate per km = ((1330 - 50)/80) = (1280/80) = Rs. 16

Question: 27

A part of monthly

Solution:

Let the per day fixed charge of hostel be x.

Excluding fixed charge, a student pays Rs. (4500 - 30x) for 25 days and Rs. (5200 - 30x) for 30 days mess charge

∴ Cost of food per day is given by -

$$\left(\frac{4500 - 30x}{25}\right) = \left(\frac{5200 - 30x}{30}\right)$$

On Cross multiplying, we get -

⇒ 30(4500 - 30x) = 25(5200 - 30x)

⇒ 135000 - 900x = 130000 - 750x

⇒ 150x = 5000

⇒ x = (500/15)

Hence, the fixed charge of hostel per month = (500/15)×30 = Rs. 1000

and, Rate per km = ((4500 - 1000)/25) = (3500/25) = Rs. 140

Question: 28

A man invested an

Solution:

Let the amount invested at 10% per annum and 8% per annum be x and y respectively.

According to question -

Annual Interest on amount x + Annual Interest of amount y = Rs. 1350

$$\frac{10x}{100} + \frac{8y}{100} = 1350$$

⇒ 10x + 8y = 135000

⇒ 5x + 4y = 67500.....(1)

and,

Annual Interest on amount y + Annual Interest of amount x = Rs. 1305

$$\therefore \frac{10y}{100} + \frac{8x}{100} = 1305$$

⇒ 8x + 10y = 130500

⇒ 4x + 5y = 65250.....(2)

From equation (1), we get -

x = (67500 - 4y)/5.....(3)

Substituting the value of x in equation (2), we get -

$$4\left(\frac{67500 - 4y}{5}\right) + 5y = 65250$$

$\Rightarrow 54000 - \frac{16}{5}y + 5y = 65250$

$\Rightarrow (9/5)y = 11250$

$\therefore y = 6250$

substituting the value of y in equation (3), we get -

x = 8500

Thus, the amount invested at 10% per annum = Rs. 8500 and,

the amount invested at 8% per annum = Rs. 6250

Question: 29

The monthly incom

Solution:

Let the monthly incomes of A and B are 5x and 4x respectively. Also their monthly expenditures are 7y and 5y respectively.

According to question -

Savings of family A = 5x - 7y = 9000.....(1)

Savings of family B = 4x - 5y = 9000.....(2)

Subtracting equation (2) from (1), we get -

x = 2y.....(3)

Substitute the value of x in equation (1), we get -

y = 3000

Substitute the value of y in equation (3), we get -

x = 6000

Thus, the monthly income of A = 5x = Rs.30000

and, the monthly income of B = 4x = Rs.24000

Question: 30

A man sold a chai

Solution:

Let the cost price of each chair and that of a table be x and y respectively.

According to question -

Selling Price of a chair(Profit = 25%) + Selling Price of a table(Profit = 10%) = Rs. 1520

$\therefore x\left(1 + \frac{25}{100}\right) + y\left(1 + \frac{10}{100}\right) = 1520$

$\Rightarrow \frac{5}{4}x + \frac{11}{10}y = 1520$

$\Rightarrow 25x + 22y = 30400$.....(1)

and,

Selling Price of a chair(Profit = 10%) + Selling Price of a table(Profit = 25%) = Rs. 1535

$$\Rightarrow x\left(1 + \frac{10}{100}\right) + y\left(1 + \frac{25}{100}\right) = 1535$$

$\Rightarrow \frac{11}{10}x + \frac{5}{4}y = 1535$

$\Rightarrow 22x + 25y = 30700$.....(2)

Subtracting equation (2) from equation (1), we get -

$\Rightarrow 3x - 3y = - 300$

$\Rightarrow x - y = - 100$.....(3)

From equation (3), we get -

$x = y - 100$

Substituting the value of x in equation (2), we get -

$22(y - 100) + 25y = 30700$

$\Rightarrow 47y = 32900$

$\therefore y = 700$

substituting the value of y in equation (3), we get -

$x = 600$

Thus, Cost price of each chair and that of a table are Rs. 600 and Rs. 700 respectively.

Question: 31

Points A and B ar

Solution:

Let the speed of the 1st car at point A and 2nd car at point B travelling in positive x - axis direction be x and y respectively.

Case 1: Same Direction

Distance Travelled by 1st and 2nd Car in 7 hours are 7x and 7y respectively.

Both the cars will meet outside of the points A and B which are 70 km apart. So, the 1st car will travel 70 km more distance from 2nd car meeting each other in 7 hours.

$\therefore 7x - 7y = 70$

$\Rightarrow x - y = 10$.....(1)

Case 2: Opposite Direction

Distance Travelled by 1st and 2nd Car in 1 hours are x and y respectively.

Both the cars will meet in between the points A and B which are 70 km apart. So, the sum of distance travelled by 1st car and distance travelled by 2nd car meeting each other in 1 hours is equal to 70 km.

$\therefore x + y = 70$ .....(2)

Adding equations (1) and (2), we get -

$2x = 80$

$\therefore x = 40$

substitute the value of x in equation (2), we get -

$y = 30$

Thus, the speed of 1st car = 40 km/h

and, the speed of 2nd car = 30 km/h

Question: 32

A train covered a

Solution:

Let the speed of train be s kmph and the scheduled time be t hours

Also, Let the length of journey be d.

$\therefore$ s × t = d.....(1)

According to question -

(s + 5)(t - 3) = d

$\Rightarrow$ st - 3s + 5t - 15 = d

$\Rightarrow$ 3s - 5t = - 15.....(2) [$\because$ s × t = d from (1)]

and,

(s - 4)(t + 3) = d

$\Rightarrow$ st + 3s - 4t - 12 = d

$\Rightarrow$ 3s - 4t = 12.....(3) [$\because$ s × t = d from (1)]

Subtracting equation (2) from (3), we get -

t = 27

Substituting the value of t in equation (3), we get -

s = 40

$\therefore$ d = s × t = 40×27 = 1080 km

Thus, the length of the journey = 1080 Km

Question: 33

Abdul travelled 3

Solution:

Let the speed of the train and that of the taxi be x kmph and y kmph respectively.

According to question -

$\frac{300}{x} + \frac{200}{y} = \frac{11}{2}$.....(1)

and,

$\frac{260}{x} + \frac{240}{y} = \frac{28}{5}$.....(2)

From equation (1), we get -

$\frac{1}{x} = \frac{1}{300}\left(\frac{11}{2} - \frac{200}{y}\right)$.....(3)

Substitute equation (3) in (2), we get -

$$\frac{260}{300}\left(\frac{11}{2} - \frac{200}{y}\right) + \frac{240}{y} = \frac{28}{5}$$

$$\Rightarrow \frac{143}{30} - \frac{520}{3}\frac{1}{y} + 240\frac{1}{y} = \frac{28}{5}$$

$$\Rightarrow \frac{200}{3}\frac{1}{y} = \frac{5}{6}$$

$\Rightarrow$ y = 80

Substituting the value of y in equation (3), we get -

x = 100

Thus, the speed of train = 100 km\h and the speed of taxi = 80 km\h.

Question: 24

Places A and B ar

Solution:

Let the speed of the 1st car at point A and 2nd car at point B travelling in positive x - axis direction be x and y respectively.

Case 1: Same Direction

Distance Travelled by 1st and 2nd Car in 8 hours are 8x and 8y respectively.

Both the cars will meet outside of the points A and B which are 160 km apart. So, the 1st car will travel 160 km more distance from 2nd car meeting each other in 8 hours.

$\therefore 8x - 8y = 160$

$\Rightarrow x - y = 20$.....(1)

Case 2: Opposite Direction

Distance Travelled by 1st and 2nd Car in 2 hours are 2x and 2y respectively.

Both the cars will meet in between the points A and B which are 160 km apart. So, the sum of distance travelled by 1st car and distance travelled by 2nd car meeting each other in 2 hours is equal to 160 km.

$\therefore 2x + 2y = 160$

$\Rightarrow x + y = 80$.....(2)

Adding equations (1) and (2), we get -

$2x = 100$

$\therefore x = 50$

substitute the value of x in equation (2), we get -

$y = 30$

Thus, the speed of 1st car = 50 km/h

and, the speed of 2nd car = 30 km/h

Question: 35

A sailor goes 8 k

Solution:

Let the speed of the sailor in still water be v kmph and the speed of the current be u kmph.

According to question -

Speed of the sailor in upstream direction = v - u

Speed of the sailor in downstream direction = v + u

$\therefore 8/(v + u) = 2/3$

$\Rightarrow v + u = 12$.....(1)

and,

$\Rightarrow 8/(v - u) = 1$

$\Rightarrow v - u = 8$.....(2)

Adding equations (1) and (2), we get -

$v = 10$

Substituting the value of v in (2), we get -

$u = 2$

Thus, speed of sailor in still water = 10 kmph and speed of current = 2 kmph.

Question: 36

A boat goes 12 km

Solution:

Let the speed of the boat in still water and the speed of the stream be v kmph and u kmph respectively.

Speed of the boat in upstream direction = v - u

Speed of the boat in downstream direction = v + u

According to question -

$12/(v - u) + 40/(v + u) = 8$

$\Rightarrow 12x + 40y = 8$ [Let $1/(v - u) = x$ and $1/(v + u) = y$]

$\Rightarrow 3x + 10y = 2$ .....(1)

and,

$16/(v - u) + 32/(v + u) = 8$

$\Rightarrow 16x + 32y = 8$ [Let $1/(v - u) = x$ and $1/(v + u) = y$]

$\Rightarrow 2x + 4y = 1$.....(2)

From equation (1), we get -

$x = (2 - 10y)/3$.....(3)

Substituting the value of x in equation (2), we get -

$$2\left(\frac{2-10y}{3}\right) + 4y = 1$$

$$\Rightarrow \frac{4-20y+12y}{3} = 1$$

$\Rightarrow 4 - 8y = 3$

$\Rightarrow 8y = 1$

$\therefore y = 1/8$

$\Rightarrow v + u = 8$.....(4)

substituting the value of y in equation (3), we get -

$x = 1/4$

$\Rightarrow v - u = 4$.....(5)

Adding equations (4) and (5), we get -

$v = 6$

Substituting the value of v in equation (4), we get -

$u = 2$

Thus, Speed of the boat in still water = 6 kmph and speed of stream = 2 kmph.

Question: 37

2 men and 5 boys

Solution:

1st Method

Let the time taken by one man alone to finish the work and that taken by one boy alone to finish the work be u and v days respectively.

Time taken by 1 man to finish one part of the work = $1/u$ days

Time taken by 1 boy to finish one part of the same work = 1/v days

According to question -

2 men and 5 boys can finish a piece of work in 4 days. Therefore, to finish one part of work they will take 1/4 days

$\therefore \frac{2}{u} + \frac{5}{v} = \frac{1}{4}$ .....(1)

Similarly, 3 men and 6 boys can finish the same work in 3 days. Therefore, to finish one part of work they will take 1/3 days

$\frac{3}{u} + \frac{6}{v} = \frac{1}{3}$ .....(2)

Multiplying equation (1) by 3 and equation (2) by 2 and using the elimination method, we have

$$\begin{array}{cccc} \frac{6}{u} & + \frac{15}{v} & = & \frac{3}{4} \\ -\frac{6}{u} & - \frac{12}{v} & = & -\frac{2}{3} \\ \hline \frac{15}{v} & - \frac{12}{v} & = & \frac{3}{4}-\frac{2}{3} \\ \hline \end{array}$$

$\Rightarrow \frac{3}{v} = \frac{1}{12}$

$\Rightarrow v = 36$

Substituting the value of v in equation (1), we get -

u = 18

Thus, time taken by one man to finish the work alone = 18 days

and, time taken by one boy to finish the work alone = 36 days

Question: 38

The length of a r

Solution:

Let the length and breadth of the room be l and b meters respectively.

According to question -

l - b = 3.....(1)

and,

lb = (l + 3)(b - 2)

⇒ lb = lb - 2l + 3b - 6

⇒ 2l - 3b = - 6.....(2)

Subtracting equation (2) from [3 × equation (1)], we get -

l = 15

Substituting the value of l in equation (1), we get -

b = 12

Thus, Length of room = 15 meters and breadth of room = 12 meters.

Question: 39

The area of a rec

Solution:

Let the length and breadth of rectangle be l and b meters respectively.

area of rectangle = $l \times b$

According to question -

$(l - 5)(b + 3) = (l \times b) - 8$

$\Rightarrow lb + 3l - 5b - 15 = lb - 8$

$\Rightarrow 3l - 5b = 7$.....(1)

and,

$(l + 3)(b + 2) = (l \times b) + 74$

$\Rightarrow lb + 2l + 3b + 6 = lb + 74$

$\Rightarrow 2l + 3b = 68$.....(2)

From equation (1), we get -

$l = (5b + 7)/3$.....(3)

Substituting the value of l in equation (2), we get -

$$2\left(\frac{5b + 7}{3}\right) + 3b = 68$$

$$\Rightarrow \frac{10b + 14 + 9b}{3} = 68$$

$\Rightarrow 19b + 14 = 204$

$\Rightarrow 19b = 190$

$\Rightarrow b = 10$

Substituting the value of b in equation (3), we get -

$l = 19$

Thus, Length = 19 meters and Breadth = 10 meters.

Question: 40

The area of a rec

Solution:

Let the length and breadth of rectangle be l and b meters respectively.

area of rectangle = $l \times b$

According to question -

$(l + 3)(b - 4) = (l \times b) - 67$

$\Rightarrow lb - 4l + 3b - 12 = lb - 67$

$\Rightarrow 4l - 3b = 55$.....(1)

and,

$(l - 1)(b + 4) = (l \times b) + 89$

$\Rightarrow lb + 4l - b - 4 = lb + 89$

$\Rightarrow 4l - b = 93$.....(2)

Subtracting Equation (1) From equation (2), we get -

$b = 19$

Substituting the value of b in equation (2), we get -

$l = 28$

Thus, Length = 28 meters and Breadth = 19 meters.

Question: 41

A railway half ti

Solution:

Let the basic first class full fare and reservation charge be Rs. x and Rs. y respectively.

According to question -

Full fare + reservation charge = Rs. 4150

$\Rightarrow x + y = 4150$.....(1)

and,

[full fare + reservation charge] + [half fare + reservation charge] = Rs. 6255

$\Rightarrow x + y + (x/2) + y = 6255$

$\Rightarrow (3x/2) + 2y = 6255$.....(2)

Subtracting equation (2) from [2×equation (1)], we get -

$\Rightarrow x/2 = 2045$

$\Rightarrow x = 4090$

Substituting the value of x in the equation (1), we get -

$y = 60$

Thus, basic full fare = Rs. 4090

reservation charge = Rs. 60

Question: 42

Five years hence,

Solution:

Let the age of the man and his son be x and y years respectively.

According to question -

Five years hence, a man's age will be three times the age of his son

$x + 5 = 3(y + 5)$

$\Rightarrow x - 3y = 10$.....(1)

and,

Five years ago, the man was seven times as old as his son

$x - 5 = 7(y - 5)$

$\Rightarrow x - 7y = - 30$.....(2)

Subtracting Equation (2) from (1), we get -

$\Rightarrow -3y + 7y = 10 + 30 \Rightarrow 4y = 40 \Rightarrow y = 10$

Substituting the value of y in equation (1), we get -

$\Rightarrow x - 3(10) = 10 \Rightarrow x = 30 + 10 \Rightarrow x = 40$

Thus, Man's age, x = 40 yearsand son's age, y = 10 years

Question: 43

Two years ago, a

Solution:

Let the age of the man and his son be x and y years respectively.

According to question -

$x - 2 = 5(y - 2)$

$x - 5y = - 8$.....(1)

and,

$x + 2 = 3(y + 2) + 8$

$\Rightarrow x - 3y = 12$.....(2)

Subtracting Equation (1) from (2), we get -

$y = 10$

Substituting the value of y in equation (1), we get -

$x = 42$

Thus, Man's age = 42 years

son's age = 10 years

Question: 44

If twice the son'

Solution:

Let the age of the father and his son be x and y years respectively.

According to question -

$x + 2y = 70$.....(1)

and,

$2x + y = 95$.....(2)

Subtracting equation (2) from [2 × equation (1)], we get -

$y = 15$

Substituting the value of y in equation (2), we get -

$x = 40$

Thus, Age of father = 40 years and age of son = 15 years.

Question: 45

The present age o

Solution:

Let the age of woman and her daughter be x and y years respectively.

According to Question -

$x = 3y + 3$.....(1)

and,

$x + 3 = 10 + 2(y + 3)$

$\Rightarrow x - 2y = 13$.....(2)

Substitute equation (1) into equation (2), we get -

$y = 10$

Substituting the value of y in equation (2), we get

$x = 33$

Thus, the age of woman = 33 years

and, the age of her daughter = 10 years.

Question: 46

On selling a tea

Solution:

Let the actual price of each of the tea set and the lemon set be Rs. x and Rs. y respectively.

According to question -

[Selling price of tea set(Loss = 5%) + Selling Price of lemon Set(Profit = 15%)] - [cost price of tea set + cost price of lemon set] = Rs. 7

$\Rightarrow x\left(1-\frac{5}{100}\right)+y\left(1+\frac{15}{100}\right)-x-y=7$

⇒ - 5x + 15y = 700

⇒ - x + 3y = 140.....(1)

and,

[Selling price of tea set(Profit = 5%) + Selling Price of lemon Set(Profit = 10%)] - [cost price of tea set + cost price of lemon set] = Rs. 13

$\Rightarrow x\left(1+\frac{5}{100}\right)+y\left(1+\frac{10}{100}\right)-x-y=13$

⇒ 5x + 10y = 1300

⇒ x + 2y = 260.....(2)

Adding equations (1) and (2), we get -

5y = 400

∴ y = 80

Substituting the value of y in equation (2), we get -

x = 100

Thus, the cost of tea set = Rs. 100 and the cost of lemon tea = Rs. 80.

Question: 47

A lending library

Solution:

Let the fixed charge and the charge for each extra day be x and y respectively.

According to question -

x + 4y = 27

and,

x + 2y = 21

Subtracting equation (2) from (1), we get -

y = 3

Substituting the value of y in (2), we get -

x = 15

Thus, Fixed Charge = 15 and the charge for each extra day = Rs. 3 per day.

Question: 48

A chemist has one

Solution:

Let the 50% solution used be x litres

Total volume of solution = 10 litres (Given)

∴ 25% solution used = (10 - x) litres

Volume of acid in mixture = 40% of 10 litres = 4 litres

but, volume of acid in mixture = 50% of x + 25% of (10 - x)

$\therefore \frac{x}{2} + \frac{10-x}{4} = 4$

⇒ x + 10 = 16

⇒ x = 6 litres

Thus, 50% solution = 6 litres and 25% solution = 4 litres.

Question: 49

A jeweller has ba

Solution:

Let the weight of 18 - carat gold be x g.

∴ weight of 12 - carat gold = (120 - x) g

24 - carat equals 100% gold (Given)

∴ % of gold in 18 - carat gold = (100/24) × 18 = 75%

and % of gold in 12 - carat gold = 50%

and % of gold in 16 - carat gold = (200/3)%

Now,

75% of x + 50% of (120 - x) = (200/3)% of 120

$\Rightarrow \frac{3}{4}x + \frac{2}{4}(120-x) = 80$

⇒ x + 240 = 320

⇒ x = 80

Thus, the weight of 18 - carat gold = 80 g and the weight of 12 - carat gold = 40 g.

Question: 50

90% and 97% pure

Solution:

Let the quantity of 90% acid solution be x litres.

∴ quantity of 97% acid solution = (21 - x) litres

Now,

90% of x + 97% of (21 - x) = 95% of 21

$\Rightarrow \frac{90}{100}x + \frac{97}{100}(21-x) = \frac{95 \times 21}{100}$

⇒ 7x = 21(97 - 95)

⇒ 7x = 42

⇒ x = 6

Thus, 90% acid solution = 6 litres

97% acid solution = 21 - 6 = 15 litres

Question: 51

The larger of the

Solution:

Let the bigger supplementary angle be $x°$.

and smaller supplementary angle be $y°$.

According to question -

$x° + y° = 180°$.....(1)

[∵ properties of supplementary angles]

and,

$x° - y° = 18°$.....(2)

Adding equations (1) and (2), we get -

$x° = 99°$

Substituting the value of $x°$ in equation (1), we get -

$y° = 81°$

Thus , the two supplementary angles are 81° and 99°.

Question: 52

In a ΔABC,

Solution:

In a Δ ABC,

$\angle A + \angle B + \angle C = 180°$

[∴ In any ΔABC, the sum of all the angles is 180°]

$\Rightarrow x° + (3x - 2)° + y° = 180°$

$\Rightarrow 4x° + y° = 182°$.....(1)

and,

$\angle C - \angle B = 9°$ (Given)

$\Rightarrow - 3x° + y° = 7°$.....(2)

Subtracting equation (2) from equation (1), we get -

$7x° = 175°$

$\Rightarrow x° = 25°$

Substituting the value of $x°$ in equation (2), we get -

$y° = 82°$

Thus, $\angle A = 25°$, $\angle B = 73°$, $\angle C = 82°$

Question: 53

In a cyclic quadr

Solution:

In a cyclic quadrilateral, the sum of opposite angles is 180° and sum of all the interior angles in a quadrilateral is 360°.

$\angle A + \angle B + \angle C + \angle D = 360°$

$\Rightarrow (2x + 4)° + (y + 3)° + (2y + 10)° + (4x - 5)° = 360°$

$\Rightarrow 6x° + 3y° = 348°$

$\Rightarrow 2x° + y° = 116°$.....(1)

and,

$\angle A + \angle C = 180°$

$\Rightarrow 2x° + 2y° = 166°$

$\Rightarrow x° + y° = 83°$.....(2)

Subtracting equation (2) from (1), we get -

$\Rightarrow x° = 33°$

Substituting the value of x° in equation (2), we get -

$y° = 50°$

Thus, $\angle A = 70°$, $\angle B = 53°$, $\angle C = 110°$, and $\angle D = 127°$

Exercise : 3F

Question: 1

Write the number

Solution:

There are two equations given in the question:

$x + 2y – 8 = 0$ ...(i)

And, $2x + 4y – 16 = 0$ ...(ii)

These given equations are in the form $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ where,

$a_1 = 1$, $b_1 = 2$ and $c_1 = – 8$

Also, $a_2 = 2 + b_2 = 4$ and $c_2 = – 16$

Now, we have:

$$\frac{a_1}{a_2} = \frac{1}{2}$$

$$\frac{b_1}{b_2} = \frac{2}{4} = \frac{1}{2}$$

And, $\frac{c_1}{c_2} = \frac{-8}{-16} = \frac{1}{2}$

$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} = \frac{1}{2}$

Hence, the pair of linear equations are coincident and therefore has infinitely many solutions

Question: 2

Find the value of

Solution:

There are two equations given in the question:

$2x + 3y – 7 = 0$ (i)

And, $(k – 1)x + (k + 2)y – 3k = 0$ (ii)

These given equations are in the form $a_1x + b_1y + c_1 = 0$ and

$a_2x + b_2y + c_2 = 0$ where,

$a_1 = 2$, $b_1 = 3$ and $c_1 = -7$

Also, $a_2 = (k - 1)$, $b_2 = (k + 2)$ and $c_2 = -3k$

Now, for the given pair of linear equations having infinitely many solutions we must have:

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

$$\frac{2}{k-1} = \frac{3}{k+2} = \frac{7}{3k}$$

$$\frac{2}{k-1} = \frac{3}{k+2}, \frac{3}{k+2} = \frac{7}{3k} \text{ and } \frac{2}{k-1} = \frac{7}{3k}$$

$2(k + 2) = 3(k - 1)$, $3 \times 3k = 7(k + 2)$ and $2 \times 3k = 7(k - 1)$

$2k + 4 = 3$, $9k = 7k + 14$ and $6k = 7k - 7$

$\therefore k = 7$, $k = 7$ and $k = 7$

Hence, the value of k is 7

Question: 3

For what value of

Solution:

There are two equations given in the question:

$10x + 5y - (k - 5) = 0$ ...(i)

And, $20x + 10y - k = 0$ ...(ii)

These given equations are in the form $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ where,

$a_1 = 10$, $b_1 = 5$ and $c_1 = -(k - 5)$

Also, $a_2 = 20$, $b_2 = 10$ and $c_2 = -k$

Now, for the given pair of linear equations having infinite many solutions we must have:

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

$$\frac{10}{20} = \frac{5}{10} = \frac{k-5}{k}$$

$$\frac{1}{2} = \frac{k-5}{k}$$

$2k - 10 = k$

$\therefore k = 10$

Hence, the value of k is 10

Question: 4

For what value of

Solution:

There are two equations given in the question:

$2x + 3y - 9 = 0$ (i)

And, $6x + (k - 2)y - (3k - 2) = 0$ (ii)

These given equations are in the form $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ where,

$a_1 = 2$, $b_1 = 3$ and $c_1 = -9$

Also, $a_2 = 6$, $b_2 = (k - 2)$ and $c_2 = -(3k - 2)$

Now, for the given pair of linear equations having no solution we must have:

$$\frac{2}{6} = \frac{3}{(k-2)} \neq \frac{9}{(3k-2)}$$

$$\frac{2}{6} = \frac{3}{(k-2)}, \frac{3}{(k-2)} \neq \frac{9}{(3k-2)}$$

$k = 11, \frac{3}{(k-2)} \neq \frac{9}{(3k-2)}$

$k = 11,\ 3(3k - 2) \neq 9(k - 2)$

$\therefore k = 11$ and $1 \neq 3$ (True)

Hence, the value of k is 11

Question: 5

Write the number

Solution:

There are two equations given in the question:

$x + 3y - 4 = 0$ ...(i)

And, $2x + 6y - 7 = 0$ ...(ii)

These given equations are in the form $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ where,

$a_1 = 1$, $b_1 = 3$ and $c_1 = -4$

Also, $a_2 = 2 + b_2 = 6$ and $c_2 = -7$

Now, we have:

$$\frac{a_1}{a_2} = \frac{1}{2}$$

$$\frac{b_1}{b_2} = \frac{3}{6} = \frac{1}{2}$$

And, $\frac{c_1}{c_2} = \frac{-4}{-7} = \frac{4}{7}$

$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Hence, the given pair of linear equation has no solution

Question: 6

Write the value o

Solution:

There are two equations given in the question:

$3x + ky = 0$ ...(i)

And, $2x - y = 0$ ...(ii)

These given equations are in the form $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ where,

$a_1 = 3$, $b_1 = k$ and $c_1 = 0$

Also, $a_2 = 2 + b_2 = -1$ and $c_2 = 0$

Now, for the given pair have a unique solution we must have:

$$\frac{a_1}{a_2} = \frac{b_1}{b_2}$$

$$\frac{3}{2} \neq \frac{k}{-1}$$

$$k \neq -\frac{3}{2}$$

Hence, $k \neq -\frac{3}{2}$

Question: 7

The difference be

Solution:

Let us assume the two numbers be x and y, where x > y

So, according to question we have:

$x - y = 5$ ...(i)

$x^2 - y^2 = 65$ ...(ii)

Now, by dividing (ii) by (i) we get:

$$\frac{x^2 - y^2}{x - y} = \frac{65}{5}$$

$$\frac{(x - y)(x + y)}{x - y} = 13$$

$x + y = 13$ ...(iii)

Now, adding (i) and (ii) we get:

$2x = 18$

$$x = \frac{18}{2} = 9$$

Putting the value of x in (iii), we get:

$9 + y = 13$

$y = 13 - 9$

$y = 4$

∴ The two numbers are 9 and 4

Question: 8

The cost of 5 pen

Solution:

Let us assume the cost of 1 pen is Rs x and that of pencil is Rs y

According to the question, we have

$5x + 8y = 120$ ...(i)

$8x + 5y = 153$ ...(ii)

Now, adding both the equations we get:

$13x + 13y = 273$

$13(x + y) = 273$

$x + y = \frac{273}{13}$

x + y = 21 ...(iii)

Now, by subtracting (i) from (ii) we get:

3x – 3y = 33

x – y = 11 ...(iv)

By adding (iii) and (iv), we get:

2x = 32

$x = \frac{32}{2} = 16$

Putting the value of x in (iii), we get

16 + y = 21

y = 21 – 16

y = 5

∴ The cost of 1 pen is Rs. 16 and that of 1 pencil is Rs. 5

Question: 9

The sum of two nu

Solution:

Let us assume the larger number be x and the smaller number be y

According to the question, we have:

x + y = 80 ...(i)

x = 4y + 5

x – 4y = 5 ...(ii)

Now, by subtracting (ii) form (i) we get

5y = 75

$y = \frac{75}{5}$

y = 15

Putting the value of y in (i), we get

x + 15 = 80

x = 80 – 15

x = 65

Hence, the two numbers be 65 and 15

Question: 10

A number consists

Solution:

Let us assume the ones digit be x and the tens digit be y

According to the question, we have

x + y = 10 ...(i)

(10y + x) – 18 = 10x + y

x – y = – 2 ...(ii)

Now, adding (i) and (ii) we get:

2x = 8

$x = \frac{8}{2} = 4$

Now by putting the value of x in (i), we get

4 + y = 10

y = 10 – 4

y = 6

Hence the required number is 64

Question: 11

A man purchased 4

Solution:

Let us assume the number of stamps of 20p and 25p be x and y respectively

According to the question, we have

x + y = 47 ...(i)

0.20x + 0.25y = 10

Also, 4x + 5y = 200 ...(ii)

From equation (i), we have

y = 47 – x

Now, putting the value of y in (ii), we get

4x + 5 (47 – x) = 200

4x – 5x + 235 = 200

x = 235 – 200

x = 35

Now putting the value of x in (i), we get:

35 + y = 47

∴ y = 47 – 35

y = 12

Hence, the number of 20p stamps are 35 and the number of 25p stamps are 12

Question: 12

A man has some he

Solution:

Let us assume the number of hens be x and that of cows be y

According to the question, we have

x + y = 48 ...(i)

2x + 4y = 140

x + 2y = 70 ...(ii)

Now, subtracting (i) from (ii) we get:

y = 22

Hence, the number of cows is 22

Question: 13

If $\frac{2}{x} + \frac{3}{y} = \frac{9}{xy}$ ...(i)

$\frac{4}{x} + \frac{9}{y} = \frac{21}{xy}$ ...(ii)

Now, multiplying (i) and (ii) by xy we get:

3x + 2y = 9 ...(iii)

9x + 4y = 21 ...(iv)

Now, multiplying (iii) by 2 and subtracting it from (iv) we get:

9x – 6x = 21 – 18

3x = 3

$x = \frac{3}{3} = 1$

Now, putting the value of x in (iii) we get:

3 × 1 + 2y = 9

3 + 2y = 9

2y = 6

$y = \frac{6}{2}$

y = 3

Hence, the value of x = 1 and y = 3

Question: 14

If $\frac{x}{4} + \frac{y}{3} = \frac{5}{12}$ ...(i)

$\frac{x}{2} + y = 1$ ...(ii)

Now, multiplying (i) by 12 and (ii) by 4 we get:

3x + 4y = 5 ...(iii)

2x + 4y = 4 ...(iv)

Now, subtracting (iv) from (iii) we get:

x = 1

Now, putting the value of x in (iv) we get:

2 + 4y = 4

4y = 2

$y = \frac{2}{4}$

$y = \frac{1}{2}$

$\therefore (x + y) = 1 + \frac{1}{2}$

$= \frac{2+1}{2}$

$= \frac{3}{2}$

Hence, the value of (x + y) is $\frac{3}{2}$

Question: 15

If 12x + 17y = 53

Solution:

We have the given pair of equations are:

12x + 17y = 53 …(i)

17x + 12y = 63 …(ii)

Now, adding (i) and (ii) we get:

29x + 29y = 116

29 (x + y) = 116

$(x + y) = \frac{116}{29}$

(x + y) = 4

∴ The value of (x + y) is 4

Question: 16

Find the value of

Solution:

The given two equations are:

3x + 5y = 0 …(i)

kx + 10y = 0 …(ii)

The given equation is a homogenous system of linear differential equation so it always has a zero solution

We know that, for having a non – zero solution it must have infinitely many solutions

$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2}$

$\frac{3}{k} = \frac{5}{10} = \frac{1}{2}$

k = 6

Hence, the value of k is 6

Question: 17

Find k for which

Solution:

The given two equations are:

kx – y – 2 = 0 …(i)

6x – 2y – 3 = 0 …(ii)

Here, we have:

$a_1 = k$, $b_1 = -1$ and $c_1 = -2$

$a_2 = 6$, $b_2 = -2$ and $c_2 = -3$

We know that, for the system having a unique solution we must have

$$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

$$\frac{k}{6} \neq \frac{-1}{-2} = \frac{1}{2}$$

$k \neq 3$

$\therefore k \neq 3$

Question: 18

Find k for which

Solution:

The given two equations are:

$2x + 3y - 5 = 0$ ...(i)

$4x + ky - 10 = 0$ ...(ii)

Here, we have:

$a_1 = 2$, $b_1 = 3$ and $c_1 = -5$

$a_2 = 4$, $b_2 = k$ and $c_2 = -10$

We know that, for the system having a infinite number of solutions we must have

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

$$\frac{2}{4} = \frac{3}{k} = \frac{-5}{-10}$$

$$\frac{1}{2} = \frac{3}{k} = \frac{1}{2}$$

$\therefore k = 6$

Hence, the value of k is 6

Question: 19

Show that the sys

Solution:

The given two equations are:

$2x + 3y - 1 = 0$ ...(i)

$4x + ky - 10 = 0$ ...(ii)

Here, we have:

a1 = 2, b1 = 2 and c1 = – 1

a2 = 4, b2 = 6 and c2 = – 4

Now, we have

$$\frac{a1}{a2} = \frac{2}{4} = \frac{1}{2}$$

$$\frac{b1}{b2} = \frac{3}{6} = \frac{1}{2}$$

$$\frac{c1}{c2} = \frac{1}{4}$$

$$\therefore \frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$$

Hence, the given system has no solution

Question: 20

Find k for which

Solution:

The given two equations are:

$x + 2y - 3 = 0$ ...(i)

$5x + ky + 7 = 0$ ...(ii)

Here, we have:

$a_1 = 1$, $b_1 = 2$ and $c_1 = -3$

$a_2 = 5$, $b_2 = k$ and $c_2 = 7$

We know that, for the system to be consistent we must have

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

$$\frac{1}{5} = \frac{2}{k} = \frac{-3}{7}$$

$$\frac{1}{5} = \frac{2}{k}$$

$k = 10$

Hence, the value of k is 10

Question: 21

Solve:

Solution:

The given two equations are:

$$\frac{3}{x+y} + \frac{2}{x-y} = 2 \text{ ...(i)}$$

$$\frac{9}{x+y} - \frac{4}{x-y} = 1 \text{ ...(ii)}$$

Now, substituting $\frac{1}{x+y} = u$ and $\frac{1}{x-y} = v$ in (i) and (ii) the given equation will changed to:

$3u + 2v = 2$ ...(iii)

$9u - 4v = 1$ ...(iv)

Now, by multiplying (i) by 2 and adding it with (ii) we get:

$15u = 4 + 1$

$$u = \frac{1}{3}$$

Also, by multiplying (i) by 3 and subtracting it from (ii) we get:

$6u + 4v = 6 - 1$

$$u = \frac{5}{10} = \frac{1}{2}$$

$\therefore$ x + y = 3 ...(v)

And, x – y = 2 ...(vi)

Now, adding (v) and (vi) we get:

2x = 5

$x = \frac{5}{2}$

Now substituting the value of x in (v), we get:

$\frac{5}{2} + y = 3$

$y = 3 - \frac{5}{2}$

$y = \frac{6-5}{2}$

$y = \frac{1}{2}$

Exercise : MULTIPLE CHOICE QUESTIONS (MCQ)

Question: 1

If 2x + 3y = 12 a

Solution:

We have:

2x + 3y = 12 ...(i)

3x – 2y = 5 ...(ii)

Now, by multiplying (i) by 2 and (ii) by 3 and then adding them we get:

4x + 9x = 24 + 15

13x = 39

$x = \frac{39}{13} = 3$

Now putting the value of x in (i), we get

2 × 3 + 3y = 12

$\therefore y = \frac{12-6}{3} = 2$

Hence, option C is correct

Question: 2

If x – y = 2 and

Solution:

We have:

x – y = 2 ...(i)

x + y = 10 ...(ii)

Now, adding (i) and (ii) we get:

2x = 12

$x = \frac{12}{2}$

x = 6

Putting the value of x in (ii), we get

6 + y = 10

y = 10 – 6

y = 4

Hence, option C is correct

Question: 3

If $\frac{2x}{3} - \frac{y}{2} = -\frac{1}{6}$ ...(i)

$\frac{x}{2} + \frac{2y}{3} = 3$ ...(ii)

Now, multiplying (i) and (ii) by 6 we get:

4x – 3y = – 1 ...(iii)

3x + 4y = 18 ...(iv)

Now, multiplying (iii) by 4 and (iv) by 3 and adding them we get:

16x + 9x = – 4 + 54

$x = \frac{50}{25} = 2$

Putting the value of x in (iv) we get:

3 × 2 + 4y = 18

$y = \frac{18 - 6}{4}$

y = 3

Hence, option A is correct

Question: 4

If $\frac{1}{x} + \frac{2}{y} = 4$ ...(i)

$\frac{3}{y} - \frac{1}{x} = 11$ ...(ii)

Now, adding (i) and (ii) we get:

$\frac{2}{y} + \frac{3}{y} = 15$

$\frac{5}{y} = 15$

$y = \frac{5}{15} = \frac{1}{3}$

Putting the value of y in (i), we get

$\frac{1}{x} + 2 \times 3 = 4$

$\frac{1}{x} = 4 - 6$

$x = -\frac{1}{2}$

Hence, option D is correct

Question: 5

If $\frac{2x+y+2}{5} = \frac{3x-y+1}{3}$ and $\frac{3x-y+1}{3} = \frac{3x+2y+1}{3}$

By simplifying above equations, we get:

3 (2x + y + 2) = 5 (3x – y + 1)

6x + 3y + 6 = 15x – 5y + 5

9x – 8y = 1 ...(i)

And, 6 (3x – y + 1) = 3 (3x + 2y + 1)

18x – 6y + 6 = 9x + 6y + 3

3x – 4y = – 1 ...(ii)

Now, multiplying (ii) by 2 and then subtracting it from (i) we get:

9x – 6x = 1 + 2

∴ x = 1

Putting the value of x in (ii), we get

3 × 1 – 4y = – 1

$\therefore y = \frac{3+1}{4} = 1$

Hence, option A is correct

Question: 6

If $\frac{3}{x+y} + \frac{2}{x-y} = 2$ ...(i)

$\frac{9}{x+y} - \frac{4}{x-y} = 1$ ...(ii)

Now, substituting $\frac{1}{x+y} = u$ and $\frac{1}{x-y} = v$ in (i) and (ii) we get:

3u + 2v = 2 ...(iii)

9u – 4v = 1 ...(iv)

Multiplying (iii) by 2 and adding it with (iv) we get:

6u + 9u = 4 + 1

$u = \frac{5}{15}$

$u = \frac{1}{3}$

Multiplying again (iii) by 2 and then subtracting it from (iv), we get:

6v + 4v = 6 – 1

$v = \frac{5}{10}$

$v = \frac{1}{2}$

∴ x + y = 3 ...(v)

And, x – y = 2 ...(vi)

Now, by adding (v) and (vi) we get:

2x = 3 + 2

$$x = \frac{5}{2}$$

Substituting the value of x in (v), we get

$$\frac{5}{2} + y = 3$$

$$y = 3 - \frac{5}{2}$$

$$y = \frac{6 - 5}{2}$$

$$y = \frac{1}{2}$$

Hence, option B is correct

Question: 7

If 4x + 6y = 3xy

Solution:

We have,

4x + 6y = 3xy ...(i)

8x + 9y = 5xy ...(ii)

Now, dividing (i) and (ii) by xy we get:

$\frac{6}{x} + \frac{4}{y} = 3$ ...(iii)

Also, $\frac{9}{x} + \frac{8}{y} = 5$ ...(iv)

Now, multiplying (iii) by2 and then subtracting it from (iv) we get:

$$\frac{12}{x} - \frac{9}{x} = 6 - 5$$

$$\frac{3}{x} = 1$$

∴ x = 3

Now, substituting the value of x in (iii) we get:

$$\frac{6}{3} + \frac{4}{y} = 3$$

$$\frac{4}{y} = 1$$

∴ y = 4

Hence, option C is correct

Question: 8

If 29x + 37y = 10

Solution:

We have,

$29x + 37y = 103$ ...(i)

$37x + 29y = 95$ ...(ii)

Now, adding both the equations we get:

$66x + 66y = 198$

$66(x + y) = 198$

$$(x + y) = \frac{198}{66}$$

$x + y = 3$ ...(iii)

Now, subtracting (i) from (ii) we get:

$8x - 8y = -8$

$x - y = -1$ ...(iv)

Now adding (iii) and (iv), we get

$2x = 2$

$\therefore x = 1$

Putting the value of x in (iii), we get

$1 + y = 3$

$\therefore y = 3 - 1 = 2$

Hence, option A is correct

Question: 9

If $2^{x + y}$

Solution:

We have,

$$2x + y = 2x - y = \sqrt{8}$$

$\therefore x + y = x - y$

Hence, y = o

Thus, option C is correct

Question: 10

If $\frac{2}{x} + \frac{3}{y} = 6$ ...(i)

Also, $\frac{1}{x} + \frac{1}{2y} = 2$ ...(ii)

Now, multiplying (ii) by 2 and then subtracting it from (ii) we get:

$$\frac{3}{y} - \frac{1}{y} = 6 - 4$$

$$\frac{2}{y} = 2$$

$\therefore y = 1$

Now substituting the value of y in (ii), we get:

$$\frac{1}{x} + \frac{1}{2} = 2$$

$$\frac{1}{x} = 2 - \frac{1}{2}$$

$$\frac{1}{x} = \frac{3}{2}$$

$$\therefore x = \frac{2}{3}$$

Hence, option B is correct

Question: 11

The system kx – y

Solution:

We have,

kx – y – 2 = 0 (i)

6x – 2y – 3 = 0 (ii)

Here, a_1 = k, b_1 = – 1 and c_1 = – 2

a_2 = 6, b_2 = – 2 and c_2 = – 3

We know that, for the system having a unique solution it must have:

$$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

$$\frac{k}{6} \neq \frac{-1}{-2}$$

$\therefore k \neq 3$

Hence, option D is correct

Question: 12

The system x – 2y

Solution:

We have,

x – 2y – 3 = 0

3x + ky – 1 = 0

The given equation is in the form: $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$

Here, we have:

a_1 = 1, b_1 = – 2 and c_1 = – 3

And, a_2 = 3, b_2 = k and c_2 = – 1

$\therefore \frac{a_1}{a_2} = \frac{1}{3}, \frac{b_1}{b_2} = -\frac{2}{k}$ and $\frac{c_1}{c_2} = 3$

These graph lines will intersect at a unique point when we have:

$$\frac{a1}{a2} \neq \frac{b_1}{b_2}$$

$$\frac{1}{3} \neq \frac{-2}{k}$$

$\therefore k \neq -6$

Hence, k has all real values other than – 6

Thus, option B is correct

Question: 13

The system x + 2y

Solution:

We have,

$x + 2y - 3 = 0$

And, $5x + ky + 7 = 0$

Here, $a_1 = 1$, $b_1 = 2$ and $c_1 = -3$

$a_2 = 5$, $b_2 = k$ and $c_2 = 7$

$\therefore \frac{a_1}{a_2} = \frac{1}{5}$

$\frac{b_1}{b_2} = \frac{2}{k}$

And, $\frac{c_1}{c_2} = \frac{-3}{7}$

We know that, for the system having no solution we must have:

$\frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$

$\frac{1}{5} = \frac{2}{k} \neq \frac{-3}{7}$

$\therefore k = 10$

Hence, option A is correct

Question: 14

If the lines give

Solution:

We have,

$3x + 2ky - 2 = 0$

And, $2x + 5y + 1 = 0$

Here, $a_1 = 3$, $b_1 = 2k$ and $c_1 = -2$

$a_2 = 2$, $b_2 = 5$ and $c_2 = 1$

$\therefore \frac{a_1}{a_2} = \frac{3}{2}$

$\frac{b_1}{b_2} = \frac{2k}{5}$

And, $\frac{c_1}{c_2} = \frac{-2}{1}$

We know that, for the system having parallel lines we must have:

$\frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$

$\frac{3}{2} = \frac{2k}{5} \neq \frac{-2}{1}$

$\therefore k = \frac{15}{4}$

Hence, option D is correct

Question: 15

For what value of

Solution:

We have,

kx – 2y – 3 = 0

And, 3x + y – 5 = 0

Here, $a_1 = k$, $b_1 = -2$ and $c_1 = -3$

$a_2 = 3$, $b_2 = 1$ and $c_2 = -5$

$\therefore \frac{a_1}{a_2} = \frac{k}{3}$

$\frac{b_1}{b_2} = \frac{-2}{1}$

And, $\frac{c_1}{c_2} = \frac{3}{5}$

We know that, for these graphs intersect at a unique point we must have:

$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

$\frac{k}{3} \neq \frac{-2}{1}$

$\therefore k \neq -6$

Hence, the lines of the graph will intersect at all real values of k except – 6

Thus, option D is correct

Question: 16

The pair of equat

Solution:

We have,

x + 2y + 5 = 0

And, – 3x – 6y + 1 = 0

Here, $a_1 = 1$, $b_1 = 2$ and $c_1 = 5$

$a_2 = -3$, $b_2 = -6$ and $c_2 = 1$

$\therefore \frac{a_1}{a_2} = \frac{1}{-3}$

$\frac{b_1}{b_2} = \frac{2}{-6} = \frac{1}{-3}$

And, $\frac{c_1}{c_2} = \frac{5}{1}$

$\therefore \frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$

Hence, the given system has no solution

Thus, option D is correct

Question: 17

The pair of equat

Solution:

We have,

$2x + 3y - 5 = 0$

And, $4x + 6y - 15 = 0$

Here, $a_1 = 2$, $b_1 = 3$ and $c_1 = -5$

$a_2 = 4$, $b_2 = 6$ and $c_2 = -15$

$\therefore \frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}$

$\frac{b_1}{b_2} = \frac{3}{6} = \frac{1}{2}$

And, $\frac{c_1}{c_2} = \frac{-5}{-15} = \frac{1}{3}$

$\therefore \frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$

Hence, the given system has no solution

Thus, option D is correct

Question: 18

If a pair of line

Solution:

We know that,

If a pair of linear equations is consistent then their graph lines will either intersect at a point or coincidence

Hence, option D is correct

Question: 19

If a pair of line

Solution:

We know that,

If a pair of linear equations is inconsistent then their graph lines do not intersect each other and there will be no solution exists. Hence, the lines are parallel

Thus, option A is correct

Question: 20

In a ΔABC,

Solution:

Let us assume, $\angle A = x^o$ and $\angle B = y^o$

$\therefore \angle A = 3 \angle B = (3y)^o$

We know that, sum of all sides of the triangle is equal to 180^o

$\therefore \angle A + \angle B + \angle C = 180^o$

$x + y + 3y = 180^o$

$x + 4y = 180^o$ (i)

Also we have, $\angle C = 2 (\angle A + \angle B)$

$3y = 2(x + y)$

$2x - y = 0$ (ii)

Now, by multiplying (ii) by 4 we get:

$8x - 4y = 0$ (iii)

And adding (i) and (iii), we get

$9x = 180^{\circ}$

$$x = \frac{180}{9}$$

$x = 20$

Putting the value of x in (i), we get

$20 + 4y = 180$

$4y = 180 - 20$

$4y = 160$

$$y = \frac{160}{4}$$

$y = 40$

$\therefore \angle B = y = 40^{\circ}$

Hence, option B is correct

Question: 21

In a cyclic quadr

Solution:

It is given in the question that,

In cyclic quadrilateral ABCD, we have:

$\angle A = (x + y + 10)^{\circ}$

$\angle B = (y + 20)^{\circ}$

$\angle C = (x + y - 30)^{\circ}$

$\angle D = (x + y)^{\circ}$

As ABCD is a cyclic quadrilateral

$\therefore \angle A + \angle C = 180^{\circ}$ and $\angle B + \angle D = 180^{\circ}$

Now, $\angle A + \angle C = 180^{\circ}$

$(x + y + 10)^{\circ} + (x + y - 30)^{\circ} = 180^{\circ}$

$2x + 2y - 20^{\circ} = 180^{\circ}$

$x + y = 100^{\circ}$ (i)

Also, $\angle B + \angle D = 180^{\circ}$

$(y + 20)^{\circ} + (x + y)^{\circ} = 180^{\circ}$

$x + 2y + 20^{\circ} = 180^{\circ}$

$x + 2y = 160^{\circ}$ (ii)

On subtracting (i) from (ii), we get

$y = (160 - 100)^o$

$y = 60^o$

Putting the value of y in (i), we get

$x + 60^o = 100^o$

$x = 100^o - 60^o$

$x = 40^o$

$\therefore \angle B = (y + 20)^o$

$\angle B = 60^o + 20^o = 80^o$

Hence, option B is correct

Question: 22

The sum of the di

Solution:

Let us assume the tens and the unit digits of the required number be x and y respectively

$\therefore$ Required number = (10x + y)

According to the given condition in the question, we have

x + y = 15 (i)

By reversing the digits, we obtain the number = (10y + x)

$\therefore$ (10y + x) = (10x + y) + 9

10y + x – 10x – y = 9

9y – 9x = 9

y – x = 1 (ii)

Now, on adding (i) and (ii) we get:

2y = 16

$\therefore\ y = \frac{16}{2} = 8$

Putting the value of y in (i), we get:

x + 8 = 15

x = 15 – 8

x = 7

$\therefore$ Required number = (10x + y)

= 10 × 7 + 8

= 70 + 8

= 78

Hence, option D is correct

Question: 23

In a given fracti

Solution:

Let the fraction be $\frac{x}{y}$

According to the question,

$$\frac{(x-1)}{(y+2)} = \frac{1}{2}$$

2x – 2 = y + 2

y = 2x – 4 …(i)

And,

$$\frac{(x-7)}{(y-2)} = \frac{1}{2}$$

3x – 21 = y – 2

3x = y + 19 …(ii)

Using (i) in (ii)

3x = 2x – 4 + 19

X = 15

Using value of x in (i), we get

y = 2 (15) – 4

y = 30 – 4

y = 26

Therefore, required fraction = $\frac{15}{26}$

Hence, option B is correct

Question: 24

5 years hence, th

Solution:

Let us assume the present age of men be x years

Also, the present age of his son be y years

According to question, after 5 years:

(x + 5) = 3 (y + 5)

x + 5 = 3y + 15

x – 3y = 10 …(i)

Also, five years ago:

(x – 5) = 7 (y – 5)

x – 5 = 7y – 35

x – 7y = – 30 …(ii)

Now, on subtracting (i) from (ii) we get:

– 4y = – 40

y = 10

Putting the value of y in (i), we get

x – 3 × 10 = 10

x – 30 = 10

x = 10 + 30

x = 40

∴ The present age of men is 40 years

Hence, option D is correct

Question: 25

The graphs of the

Solution:

We have,

6x – 2y + 9 = 0

And, 3x – y + 12 = 0

Here, $a_1 = 6$, $b_1 = -2$ and $c_1 = 9$

$a_2 = 3$, $b_2 = -1$ and $c_2 = 12$

$\therefore \frac{a1}{a2} = \frac{6}{3} = \frac{2}{1}, \frac{b1}{b2} = \frac{-2}{-1} = \frac{2}{1}$ and $\frac{c1}{c2} = \frac{9}{12} = \frac{3}{4}$

Clearly, $\frac{a1}{a2} = \frac{b1}{b2} \neq \frac{c1}{c2}$

Hence, the given system has no solution and the lines are parallel

∴ Option B is correct

Question: 26

The graphs of the

Solution:

We have,

2x + 3y – 2 = 0

And, x – 2y – 8 = 0

Here, $a_1 = 2$, $b_1 = 3$ and $c_1 = -2$

And, $a_2 = 1$, $b_2 = -2$ and $c_2 = -8$

$\therefore \frac{a1}{a2} = \frac{2}{1}, \frac{b1}{b2} = \frac{3}{-2}$ and $\frac{c1}{c2} = \frac{-2}{-8} = \frac{1}{4}$

Clearly, $\frac{a1}{a2} \neq \frac{b1}{b2}$

Hence, the given system has a unique solution and the lines intersect exactly at one point

∴ Option C is correct

Question: 27

The graphs of the

Solution:

We have,

5x – 15y – 8 = 0

And, $3x - 9y - \frac{24}{5} = 0$

Here, $a_1 = 5$, $b_1 = -15$ and $c_1 = -8$

And, $a_2 = 3$, $b_2 = -9$ and $c_2 = -\frac{24}{5}$

$\therefore \frac{a_1}{a_2} = \frac{5}{3}, \frac{b_1}{b_2} = \frac{-15}{-9} = \frac{5}{3}$ and $\frac{c_1}{c_2} = -8 \times \frac{5}{-24} = \frac{5}{3}$

Clearly, $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

Hence, the given system has a unique solution and the lines are coincident

∴ Option A is correct

Exercise : FORMATIVE ASSESSMENT (UNIT TEST)

Question: 1

The graphic repre

Solution:

Given: Two equations, x + 2y = 3

⇒ x + 2y – 3 = 0 - - - - (1)

2x + 4y + 7 = 0 - - - - (2)

We know that the general form for a pair of linear equations in 2 variables x and y is $a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$.

Comparing with above equations,

we have $a_1 = 1$, $b_1 = 2$, $c_1 = -3$; $a_2 = 2$, $b_2 = 4$, $c_2 = 7$

$$\frac{a_1}{a_2} = \frac{1}{2}; \frac{b_1}{b_2} = \frac{2}{4} = \frac{1}{2}; \frac{c_1}{c_2} = \frac{-3}{7}$$

Since $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

∴Both lines are parallel to each other.

Question: 2

If 2x - 3y = 7 an

Solution:

Given: Two equations, 2x – 3y = 7

⇒ 2x – 3y – 7 = 0

(a + b) x – (a + b – 3) y = 4a + b

(a + b) x – (a + b – 3) y – (4a + b) = 0

We know that the general form for a pair of linear equations in 2 variables x and y is $a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$.

Comparing with above equations,

we have $a_1 = 2$,

$b_1 = -3$,

$c_1 = -7$;

$a_2 = a + b$,

$b_2 = -(a + b - 3)$,

$c_2 = -(4a + b)$

$$\frac{a_1}{a_2} = \frac{2}{(a + b)}$$

$$\frac{b_1}{b_2} = \frac{-3}{-(a+b-3)} = \frac{3}{(a+b-3)}$$

$$\frac{c_1}{c_2} = \frac{-7}{-(4a+b)} = \frac{7}{(4a+b)}$$

Since, it is given that the equations have infinite number of solutions, then lines are coincident and

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

So, $\frac{2}{(a+b)} = \frac{3}{(a+b-3)} = \frac{7}{(4a+b)}$

Let us consider $\frac{2}{(a+b)} = \frac{3}{(a+b-3)}$

Then, by cross multiplication, 2(a + b – 3) = 3(a + b)

⇒ 2a + 2b – 6 = 3a + 3b

⇒ a + b + 6 = 0 ... (1)

Now consider $\frac{3}{(a+b-3)} = \frac{7}{(4a+b)}$

Then, 3(4a + b) = 7(a + b – 3)

⇒ 12a + 3b = 7a + 7b – 21

⇒ 5a – 4b + 21 = 0 ... (2)

Solving equations (1) and (2),

5 × (1), (5a + 5b + 30) – (5a – 4b + 21) = 0

⇒ 9b + 9 = 0

⇒ 9b = - 9

⇒ b = - 1

Substitute b value in (1),

a - 1 + 6 = 0

a + 5 = 0

a = - 5

∴ a = - 5; b = - 1

Question: 3

The pair of equat

Solution:

Given: 2x + y – 5 = 0 and 3x + 2y – 8 = 0

We know that the general form for a pair of linear equations in 2 variables x and y is $a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$.

Comparing with above equations,

we have $a_1 = 2$, $b_1 = 1$, $c_1 = -5$; $a_2 = 3$, $b_2 = 2$, $c_2 = -8$

$$\frac{a_1}{a_2} = \frac{2}{3}$$

$\frac{b_1}{b_2} = \frac{1}{2}$

$\frac{c_1}{c_2} = \frac{-5}{-8} = \frac{5}{8}$

Since $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

The lines are intersecting.

∴The pair of equations has a unique solution.

Question: 4

If x = - y and y

Solution:

Given that x = - y and y > 0

Let us verify all the options by substituting the value of x.

Option A: $x^2y > 0$

⇒ $(-y)^2 (y) > 0$

⇒ $y^2(y) > 0$

⇒ $y^3 > 0$

Since y > 0, $y^3 > 0$ satisfies.

Option B: x + y = 0

⇒ (- y) + y = 0

0 = 0

LHS = RHS

Hence satisfies.

Option C: xy < 0

⇒ (- y)(y) < 0

⇒ $-y^2 < 0$

Hence satisfies.

Option D: $\frac{1}{x} - \frac{1}{y} = 0$

⇒ $\frac{1}{-y} - \frac{1}{y} = 0$

⇒ $\frac{-2}{y} \neq 0$

Since y > 0, also 1/y > 0 but - 2/y <0

Hence, it is not satisfied.

Question: 5

Show that the sys

Solution:

Given: - x + 2y + 2 = 0 and $\frac{1}{2}x - \frac{1}{2}y - 1 = 0$

To Prove: The system of given equations has a unique solution.

Proof:

We know that the general form for a pair of linear equations in 2 variables x and y is $a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$.

Comparing with above equations,

we have $a_1 = -1$,

$b_1 = 2$,

$c_1 = 2$;

$a_2 = 1/2$,

$b_2 = -1/2$

$c_2 = -1$

$$\frac{a_1}{a_2} = \frac{-1}{\frac{1}{2}} = -2$$

$$\frac{b_1}{b_2} = \frac{2}{-\frac{1}{2}} = -4$$

$$\frac{c_1}{c_2} = \frac{2}{-1} = -2$$

Since $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

The lines are intersecting.

The system of given equations have a unique solution.

Question: 6

For what values o

Solution:

Given: $kx + 3y = k - 2$,

$12x + ky = k$

We know that the general form for a pair of linear equations in 2 variables x and y is $a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$.

Comparing with above equations,

we have $a_1 = k$, $b_1 = 3$, $c_1 = -(k - 2)$; $a_2 = 12$, $b_2 = k$, $c_2 = -k$

$$\frac{a_1}{a_2} = \frac{k}{12}$$

$$\frac{b_1}{b_2} = \frac{3}{k}$$

$$\frac{c_1}{c_2} = \frac{-(k-2)}{-k} = \frac{k-2}{k}$$

For given equations to be inconsistent,

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

$$\frac{k}{12} = \frac{3}{k}$$

By cross multiplication, $k^2 = 36$

So, $k = \pm 6$

For $k = \pm 6$, the system of equations $kx + 3y = k - 2$, $12x + ky = k$ is inconsistent.

Question: 7

Show that the equ

Solution:

Given: $9x - 10y = 21$,

$$\frac{3}{2}x - \frac{5}{3}y - \frac{7}{2} = 0$$

To Prove: The given equations have infinitely many solutions.

Proof:

We know that the general form for a pair of linear equations in 2 variables x and y is $a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$.

Comparing with above equations,

we have $a_1 = 9$,

$b_1 = -10$,

$c_1 = -21$;

$a_2 = 3/2$,

$b_2 = -5/3$

$c_2 = -7/2$

$$\frac{a_1}{a_2} = \frac{9}{\frac{3}{2}} = 6$$

$$\frac{b_1}{b_2} = \frac{-10}{\frac{-5}{3}} = 6$$

$$\frac{c_1}{c_2} = \frac{-21}{\frac{-7}{2}} = 6$$

Since $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

The lines are coincident.

The given equations have infinitely many solutions.

Question: 8

Solve the system

Solution:

$x = 4, y = 2$

Given: $x - 2y = 0$ … (1)

$3x + 4y = 20$ …(2)

By elimination method,

Step 1: Multiply equation (1) by 3 and equation (2) by 1 to make the coefficients of x equal.

Then, we get the equations as:

$3x – 6y = 0$ … (3)

$3x + 4y = 20$ … (4)

Step 2: Subtract equation (4) from equation (3),

$(3x – 3x) + (4y + 6y) = 20 – 0$

$\Rightarrow 10y = 20$

$y = 2$

Step 3: Substitute y value in (1),

$x – 2(2) = 0$

$\Rightarrow x = 4$

<u>The solution is x = 4, y = 2.</u>

Question: 9

Show that the pat

Solution:

Given: $x - 3y = 2$ and $- 2x + 6y = 5$

To Prove: The paths represented by the given equations are parallel.

Proof:

We know that the general form for a pair of linear equations in 2 variables x and y is $a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$.

Comparing with above equations,

we have $a_1 = 1$, $b_1 = - 3$, $c_1 = - 2$; $a_2 = - 2$, $b_2 = 6$, $c_2 = - 5$

$$\frac{a_1}{a_2} = \frac{-1}{2}$$

$$\frac{b_1}{b_2} = \frac{-3}{6} = \frac{-1}{2}$$

$$\frac{c_1}{c_2} = \frac{-2}{-5} = \frac{2}{5}$$

Since $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

<u>Both lines are parallel to each other.</u>

Question: 10

The difference be

Solution:

The pair of linear equations formed is:

$a – b = 26$ … (1)

$a = 3b$ … (2)

We substitute value of a in equation (1), to get

3b – b = 26

⇒ 2b = 26

⇒ b = 13

Substituting value of b in equation (2),

a = 3(13)

⇒ a = 39

The numbers are 13 and 39.

Question: 11

Solve: 23x + 29y

Solution:

The given equations are 23x + 29y = 98, 29x + 23y = 110.

We know that the general form for a pair of linear equations in 2 variables x and y is $a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$.

Comparing with above equations,

we have $a_1 = 23$, $b_1 = 29$, $c_1 = -98$; $a_2 = 29$, $b_2 = 23$, $c_2 = -110$

We can solve by cross multiplication method using the formula

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Substituting values in the formula, we get

$$\frac{x}{29(-110) - 23(-98)} = \frac{y}{(-98)(29) - (-110)(23)} = \frac{1}{23(23) - 29(29)}$$

$$\Rightarrow \frac{x}{-3190-(-2254)} = \frac{y}{-2842-(-2530)} = \frac{1}{529-841}$$

$$\Rightarrow \frac{x}{-936} = \frac{y}{-312} = \frac{1}{-312}$$

$$\Rightarrow \frac{x}{-936} = \frac{1}{-312} \text{ and } \frac{y}{-312} = \frac{1}{-312}$$

⇒ x = 3 and y = 1

The solution is x = 3 and y = 1.

Question: 12

Solve: 6x + 3y =

Solution:

The given equations are 6x + 3y = 7xy and 3x + 9y = 11xy.

Dividing by xy on both sides of the given equations, we get

$$\frac{6}{y} + \frac{3}{x} = 7$$

$$\frac{3}{y} + \frac{9}{x} = 11$$

Then,

$$6\left(\frac{1}{y}\right) + 3\left(\frac{1}{x}\right) = 7 \ldots (1)$$

$3\left(\frac{1}{y}\right) + 9\left(\frac{1}{x}\right) = 11$ … (2)

If we substitute $\frac{1}{x} = p$ and $\frac{1}{y} = q$ in (1) and (2), we get

3p + 6q = 7 … (3)

9p + 3q = 11 … (4)

Now by elimination method,

Step 1: Multiply equation (3) by 3 and equation (4) by 1 to make the coefficients of x equal.

Then, we get the equations as:

9p + 18q = 21 … (5)

9p + 3q = 11 … (6)

Step 2: Subtract equation (6) from equation (5),

(9p – 9p) + (3q – 18q) = 11 – 21

⇒ - 15q = - 10

$\Rightarrow q = \frac{2}{3}$

Step 3: Substitute q value in (3),

$3p + 6\left(\frac{2}{3}\right) = 7$

3p = 3

⇒ p = 1

We know that $\frac{1}{x} = p$ and $\frac{1}{y} = q$.

Substituting values of p and q, we get

x = 1 and y = $\frac{3}{2}$

The solution is x = 1 and y = $\frac{3}{2}$.

Question: 13

Find the value of

Solution:

The given system of equations is 3x + y = 1 and kx + 2y = 5.

We know that the general form for a pair of linear equations in 2 variables x and y is $a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$.

Comparing with above equations,

we have $a_1 = 3$, $b_1 = 1$, $c_1 = -1$; $a_2 = k$, $b_2 = 2$, $c_2 = -5$

$$\frac{a_1}{a_2} = \frac{3}{k}$$

$$\frac{b_1}{b_2} = \frac{1}{2}$$

$$\frac{c_1}{c_2} = \frac{-1}{-5}$$

i) For the given system of equations to have a unique solution,

$$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

$\Rightarrow \frac{3}{k} \neq \frac{1}{2}$

$\Rightarrow k \neq 6$

<u>For $k \neq 6$, the given system of equations has a unique solution.</u>

ii) For the given system of equations to have no solution,

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

$\Rightarrow \frac{3}{k} = \frac{1}{2}$

$\Rightarrow k = 6$

<u>For $k = 6$, the given system of equations has no solution.</u>

Question: 14

In a ABC, ∠C

Solution:

We know that the sum of angles of a triangle is 180°

i.e. ∠A + ∠B + ∠C = 180°

The given relation is ∠C = 3 ∠B = 2(∠A + ∠B) … (1)

⇒ 3 ∠B = 2(∠A + ∠B)

⇒ 3 ∠B = 2 ∠A + 2 ∠B

⇒ 2 ∠A = ∠B

⇒ ∠A = ∠B/2

Substituting values in terms of B in equation (1),

∠B/2 + ∠B + 3 ∠B = 180°

∠B/2 + 4 ∠B = 180°

∠B(9/2) = 180°

∠B = 180 × 9/2

∠B = 40°

Substituting B value in (1),

∠C = 3 ∠B = 3(40) = 120°

And ∠A = ∠B/2 = 40/2 = 20°

<u>The measures are ∠A = 20°, ∠B = 40°, ∠C = 120°.</u>

Question: 15

5 pencils and 7 p

Solution:

Let the cost of pencils be x and cost of pens be y.

The linear equations formed are:

$5x + 7y = 195$ … (1)

$7x + 5y = 153$ … (2)

We know that the general form for a pair of linear equations in 2 variables x and y is $a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$.

Comparing with above equations,

we have $a_1 = 5$, $b_1 = 7$, $c_1 = -195$; $a_2 = 7$, $b_2 = 5$, $c_2 = -153$

We can solve by cross multiplication method using the formula

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Substituting values in the formula, we get

$$\frac{x}{7(-153) - 5(-195)} = \frac{y}{(-195)(7) - (-153)(5)} = \frac{1}{5(5) - 7(7)}$$

$$\Rightarrow \frac{x}{-1071-(-975)} = \frac{y}{-1365-(-765)} = \frac{1}{25-49}$$

$$\Rightarrow \frac{x}{-96} = \frac{y}{-600} = \frac{1}{-24}$$

$$\Rightarrow \frac{x}{-96} = \frac{1}{-24} \text{ and } \frac{y}{-600} = \frac{1}{-24}$$

$\Rightarrow x = 4$ and $y = 25$

<u>The cost of each pencil is Rs.4 and cost of each pen is Rs.25.</u>

Question: 16

Solve the followi

Solution:

For $2x - 3y = 1$,(In graph - red line)

X	2	5
$Y = \frac{2x-1}{3}$	1	3

For $4x - 3y + 1 = 0$,(In graph – blue line)

X	2	5
$Y = \frac{4x+1}{3}$	3	7

From the above graph, we observe that there is a point (- 1, - 1) common to both the lines.

So, the solution of the pair of linear equations is x = - 1 and y = - 1.

<u>The given pair of equations is consistent.</u>

Question: 17

Find the angles o

Solution:

It is given that angles of a cyclic quadrilateral ABCD are given by:

$\angle A = (4x + 20)°$,

$\angle B = (3x - 5)°$,

$\angle C = (4y)°$

and $\angle D = (7y + 5)°$.

We know that the opposite angles of a cyclic quadrilateral are supplementary.

$\angle A + \angle C = 180°$

$4x + 20 + 4y = 180°$

$4x + 4y – 160 = 0$ ... (1)

And $\angle B + \angle D = 180°$

$3x – 5 + 7y + 5 = 180°$

$3x + 7y - 180° = 0$... (2)

By elimination method,

Step 1: Multiply equation (1) by 3 and equation (2) by 4 to make the coefficients of x equal.

Then, we get the equations as:

$12x + 12y = 480$ ... (3)

$12x + 16y = 540$ ... (4)

Step 2: Subtract equation (4) from equation (3),

$(12x – 12x) + (16y - 12y) = 540 – 480$

$\Rightarrow 4y = 60$

$y = 15$

Step 3: Substitute y value in (1),

$4x – 4(15) – 160 = 0$

$\Rightarrow 4x – 220 = 0$

$\Rightarrow x = 55$

The solution is $x = 55$, $y = 15$.

Question: 18

Solve for x and y

Solution:

Let us put $\frac{1}{x+y} = p$ and $\frac{1}{x-y} = q$.

On substituting these values in the given equations, we get

$35p + 14q = 19$ ... (1)

$14p + 35q = 37$ ... (2)

We know that the general form for a pair of linear equations in 2 variables x and y is $a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$.

Comparing with above equations,

we have $a_1 = 35$, $b_1 = 14$, $c_1 = -19$; $a_2 = 14$, $b_2 = 35$, $c_2 = -37$

We can solve by cross multiplication method using the formula

$$\frac{p}{b_1c_2 - b_2c_1} = \frac{q}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Substituting values in the formula, we get

$$\frac{p}{14(-37) - 35(-19)} = \frac{q}{(-19)(14) - (-37)(35)} = \frac{1}{35(35) - 14(14)}$$

$\Rightarrow \frac{p}{-518-(-665)} = \frac{q}{-266-(-1295)} = \frac{1}{1225-196}$

$\Rightarrow \frac{p}{147} = \frac{q}{1029} = \frac{1}{1029}$

$\Rightarrow \frac{p}{147} = \frac{1}{1029}$ and $\frac{q}{1029} = \frac{1}{1029}$

$\Rightarrow p = 1/7$ and $q = 1$

Since $\frac{1}{x+y} = p$ and $\frac{1}{x-y} = q$

$\Rightarrow \frac{1}{x+y} = \frac{1}{7}$ and $\frac{1}{x-y} = 1$

$\Rightarrow x + y = 7$ … (3) and $x - y = 1$ … (4)

Adding equations (3) and (4),

$(x + x) + (y - y) = 7 + 1$

$2x = 8$

$x = 4$

Substituting x value in (4),

$4 - y = 1$

$y = 3$

<u>The solution is x = 4 and y = 3.</u>

Question: 19

If 1 is added to

Solution:

Let the fraction be x/y.

Given that $\frac{x+1}{y+1} = \frac{4}{5}$

$\Rightarrow 5x + 5 = 4y + 4$

$\Rightarrow 5x - 4y + 1 = 0$ … (1)

Also given that $\frac{x-5}{y-5} = \frac{1}{2}$

$\Rightarrow 2x - 10 = y - 5$

$\Rightarrow 2x - y - 5 = 0$ … (2)

We know that the general form for a pair of linear equations in 2 variables x and y is $a_1x + b_1y + c_1 = 0$

and $a_2x + b_2y + c_2 = 0$.

Comparing with above equations,

we have $a_1 = 5$, $b_1 = -4$, $c_1 = 1$; $a_2 = 2$, $b_2 = -1$, $c_2 = -5$

We can solve by cross multiplication method using the formula

$$\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$$

Substituting values in the formula, we get

$$\frac{x}{-4(-5) - (-1)(1)} = \frac{y}{(1)(2) - (-5)(5)} = \frac{1}{5(-1) - 2(-4)}$$

$\Rightarrow \frac{x}{20-(-1)} = \frac{y}{2-(-25)} = \frac{1}{-5-(-8)}$

$\Rightarrow \frac{x}{21} = \frac{y}{27} = \frac{1}{3}$

$\Rightarrow \frac{x}{21} = \frac{1}{3}$ and $\frac{y}{27} = \frac{1}{3}$

$\Rightarrow x = 7$ and $y = 9$

The fraction is 7/9.

Question: 20

Solve:

Solution:

Given: $\frac{ax}{b} - \frac{by}{a} = a + b$ … (1)

$ax - by = 2ab$ … (2)

Multiplying by ab to (1) and a to (2), we get

$a^2x - b^2y = a^2b + ab^2$ … (3)

$a^2x - aby = 2a^2b$ … (4)

Subtracting equation (4) from equation (3),

$(a^2x - a^2x) + (-aby) - (-b^2y) = (2a^2b - a^2b) - ab^2$

$\Rightarrow -aby + b^2y = a^2b - ab^2$

$\Rightarrow by(b - a) = ab(a - b)$

$\Rightarrow y = b(b - a) / ab(a - b)$

$\Rightarrow y = -a$

Substitute y value in (2),

$ax - b(-a) = 2ab$

$\Rightarrow ax + ab = 2ab$

$\Rightarrow ax = ab$

$\Rightarrow x = b$

The solution is $x = b$ and $y = -a$.